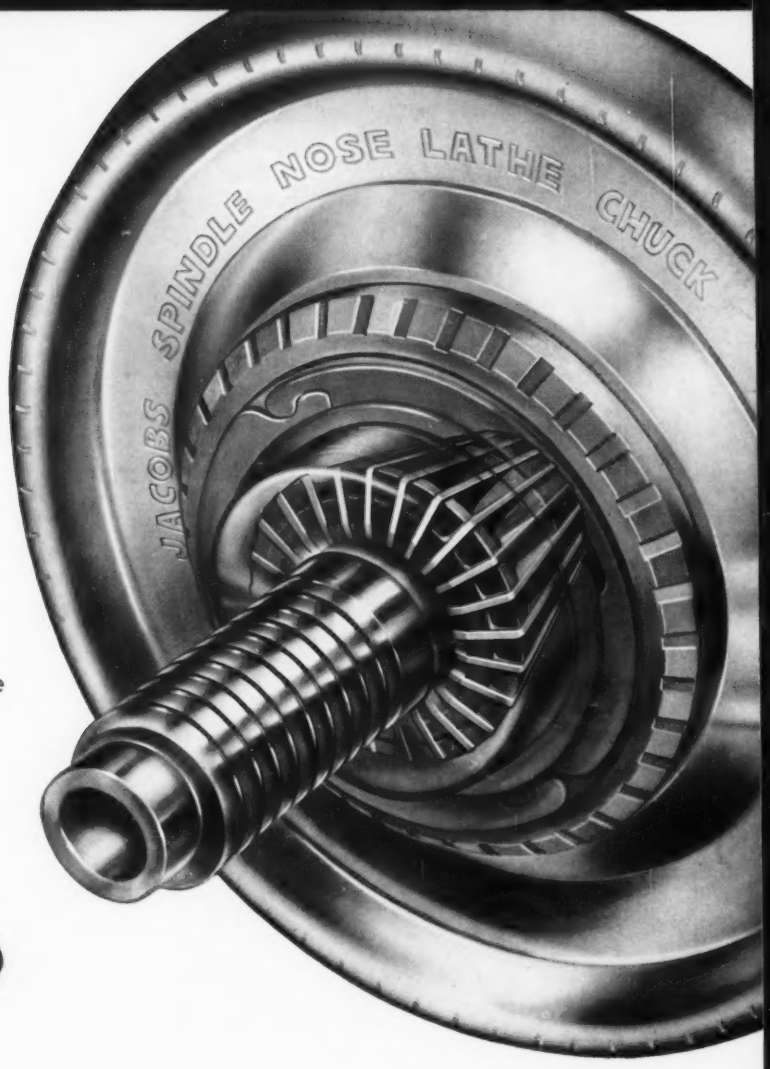
JUNE 1959—SIXTY-FIFTH YEAR

Machinery

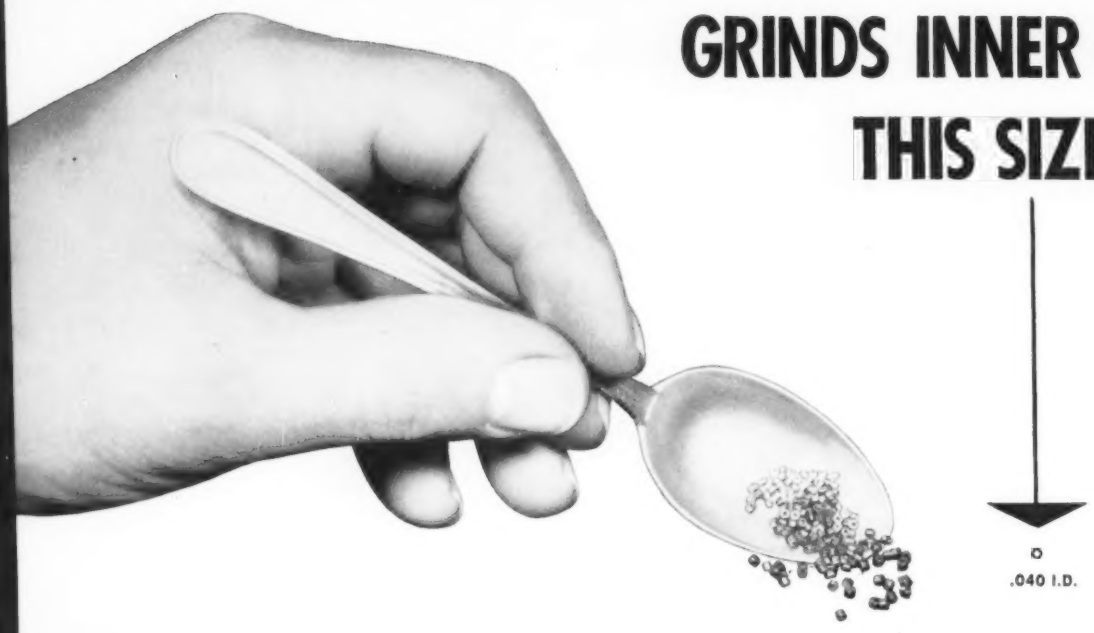


An inside look at the
tightest, most accurate
grip ever devised —
the collet with the 1/8" range

The *Jacobs* Rubber-Flex Collet in
Spindle Nose Lathe Chuck

Award-winning Model 090 Centri-Matic

GRINDS INNER RACES THIS SIZE



NEW HEALD DEVELOPMENT awarded
Certificate of Excellence in
1958 MINIATURIZATION AWARD
for unique, systems-engineered design

THIS AWARD, the first ever made to a machine tool manufacturer, cited the Model 090 for the following contributions to miniaturization.

"The Heald Model 090 Centerless Internal Grinding Machine is considered to be a radically new development, system-engineered specifically for improved production of miniature ball bearings. Whereas previous equipment had been modified to adapt it to miniature work, the Model 090 was completely designed for this purpose alone, with all components working at optimum efficiency. With this machine, inner races as small as .040" I.D. can be ground to .00015" size tolerance and 5 microinch finish in a fully automated 15-second cycle. Major advances in design include shoe-type centerless workholding with rotation from both front and rear faces — specially-designed superspeed wheelheads — hydrostatic anti-friction feeding cross slide with ultra-sensitive electronic control — and sensitized method for automatically maintaining precise wheel-to-diamond relationship and compensating for drift."

Whether you grind miniature parts or not, this development is a significant example of Heald's ability to solve tough precision-finishing problems. Your Heald engineer will welcome *your* problems, too.

HEALD

It PAYS to come to Heald

THE HEALD MACHINE COMPANY

Subsidiary of The Cincinnati Milling Machine Co.
Worcester 6, Massachusetts

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Machinery

JUNE 1959 **VOL. 65 No. 10**

THE MONTHLY MAGAZINE OF ENGINEERING AND PRODUCTION IN THE MANUFACTURE OF METAL PRODUCTS

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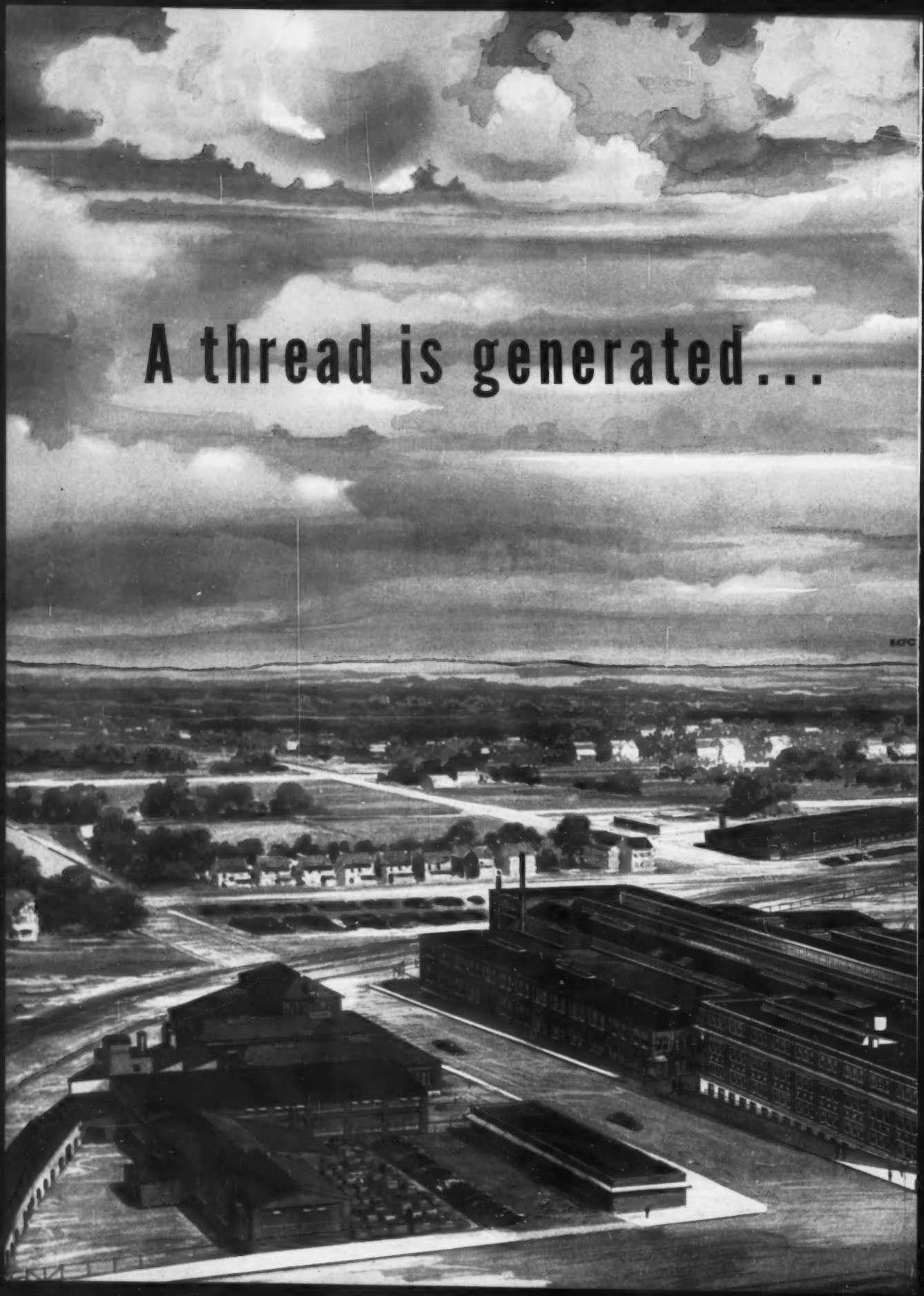
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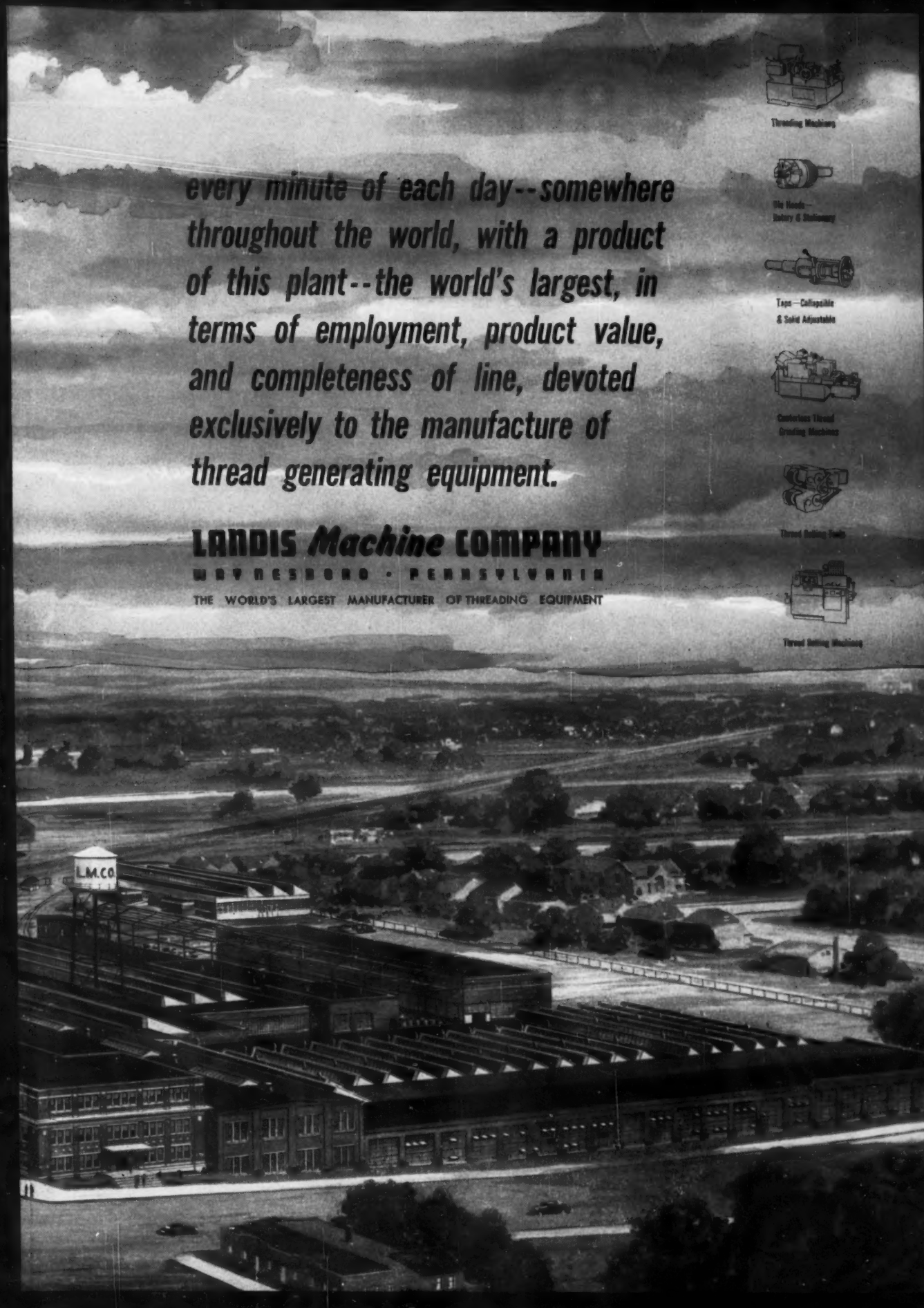
every minute of each day--somewhere throughout the world, with a product of this plant--the world's largest, in terms of employment, product value, and completeness of line, devoted exclusively to the manufacture of thread generating equipment.
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WAYNESBORO · PENNSYLVANIA
THE WORLD'S LARGEST MANUFACTURER OF THREADING EQUIPMENT
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Tops—Collapsible
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Gear Hobbing Machine

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Fellows Gear Production Equipment

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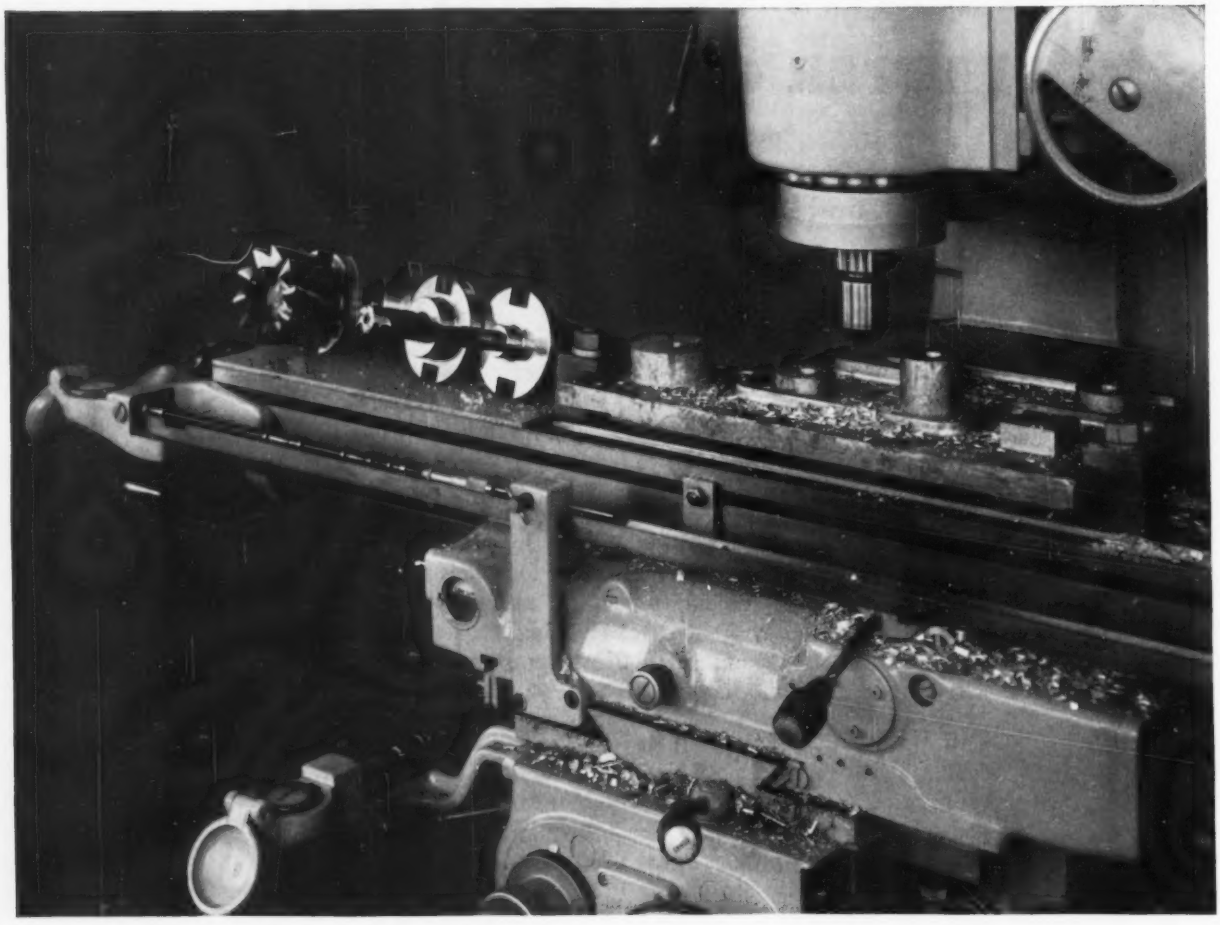
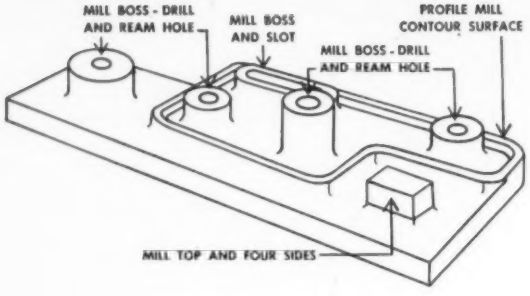
Cincinnati Milling Machines and ARBOR-LOC Cut the Cost




MILL BOSS - DRILL AND REAM HOLE
MILL BOSS AND SLOT
MILL BOSS - DRILL AND REAM HOLE
PROFILE MILL CONTOUR SURFACE
MILL TOP AND FOUR SIDES

Several operations, indicated in the drawing at the left, are completed in one setting of the work on a new CINCINNATI No. 2MI Vertical Milling Machine. Cutters for the various operations are changed in a few seconds, an exclusive CINCINNATI ARBOR-LOC advantage.

CINCINNATI

BUILDERS OF FINE MACHINE TOOLS: KNEE TYPE AND BED TYPE MILLING MACHINES • DIE SINKING MACHINES •

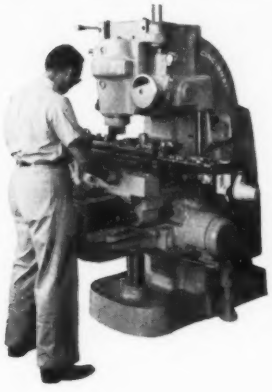
THE CINCINNATI MILLING MACHINE CO., CINCINNATI 9, OHIO

# of Multiple Operation Toolroom Milling

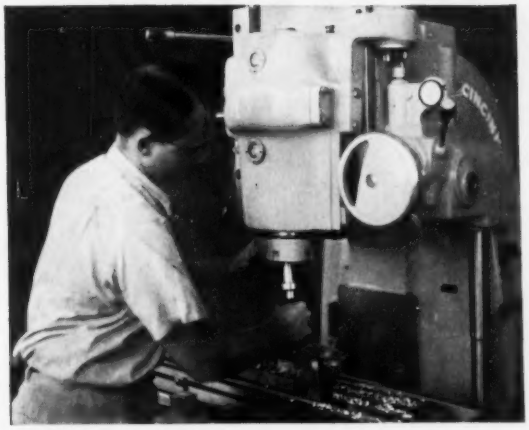
Milling machines are highly versatile machine tools... especially Cincinnati Milling Machines, with their latest feature-advantage, ARBOR-LOC. This exclusive feature is a big consideration in toolroom milling, especially when machining multiple operation parts like the cast iron bracket in the illustration.

All operations required on the part are performed on a CINCINNATI No. 2MI Vertical, the only milling machine in the 5 hp classification which has all these timesaving feature-advantages: ARBOR-LOC spindle nose, for changing cutters in a few seconds. Four-position turret stop, for accurately positioning the vertical head as required to mill the various heights of bosses. Power feed and rapid traverse to the vertical head, for drilling and boring. Precision measuring equipment (extra) for accurately locating the holes.

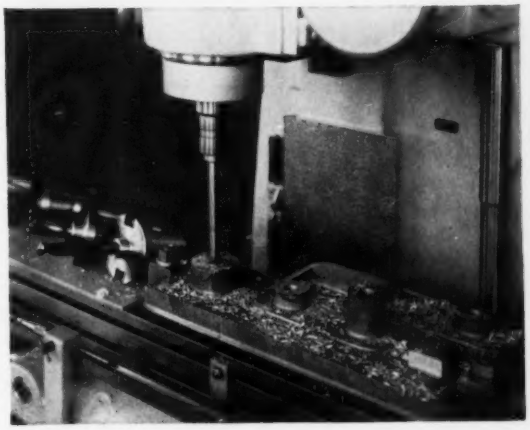
It's easy to see why CINCINNATI MIs far outclass older machines in your shop, and comparable makes of new machines. Any comparison you make will lead to one conclusion: it pays to replace with a CINCINNATI. Complete information may be obtained by writing for a copy of catalog No. M-1995-2.



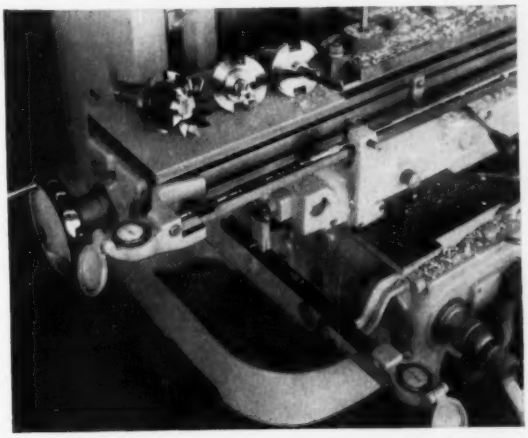
CINCINNATI No. 2MI Vertical Milling Machine. Also available in Plain and Universal styles, and 2ML Plain and Universal. Catalog No. M-1995-2.



ARBOR-LOC is the big timesaver illustrated here. Cutters are changed in a few seconds.



Power feed to the head is a useful feature-advantage for this type of work ... boring the holes.



Precision Measuring Equipment (slight extra cost) facilitates table and cross positioning for accurate spacing of machined surfaces and holes.

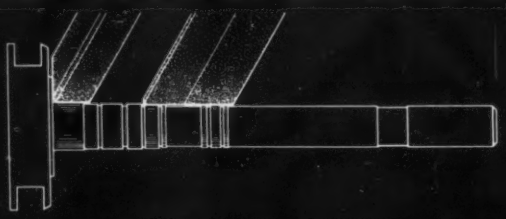
CUTTER AND TOOL GRINDERS • ELECTRICAL DISCHARGE MACHINES

CINCINNATI®
MILLING MACHINE DIVISION

For more data, circle this page number on inquiry card

new Landis R plunge

automatic production grinder



New Landis R Plunge Grinder automatically grinding 3 diameters and face of 100 transmission shafts per hour with dependable accuracy.

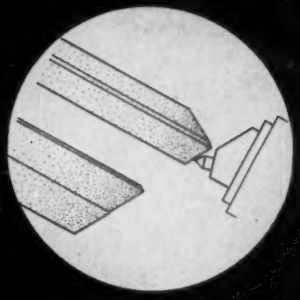
grinder

for consistent "tenths" tolerances

...completely new concept in production grinder design now gives you these new features for lower production costs

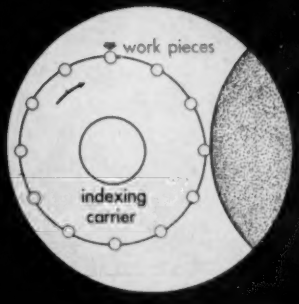
Landis MICROFEED—a new feed, symbolized by this mark, that guarantees "tenths" tolerances on a production basis

- automatically compensates for wheel wear and machine temperature variations
- eliminates costly rejects and reworking
- easy-to-set feed reduces set-up time



TRUFORM—a new dresser for accurate duplication of the profile to the wheel

- mounted on pre-loaded steel balls, to keep friction to a minimum for easy movement and accurate dressing
- dresses profiled wheels with angles up to 60°
- pushbutton control assures uniform dressing cycles



NEW Landis design assures stability and convenient maintenance

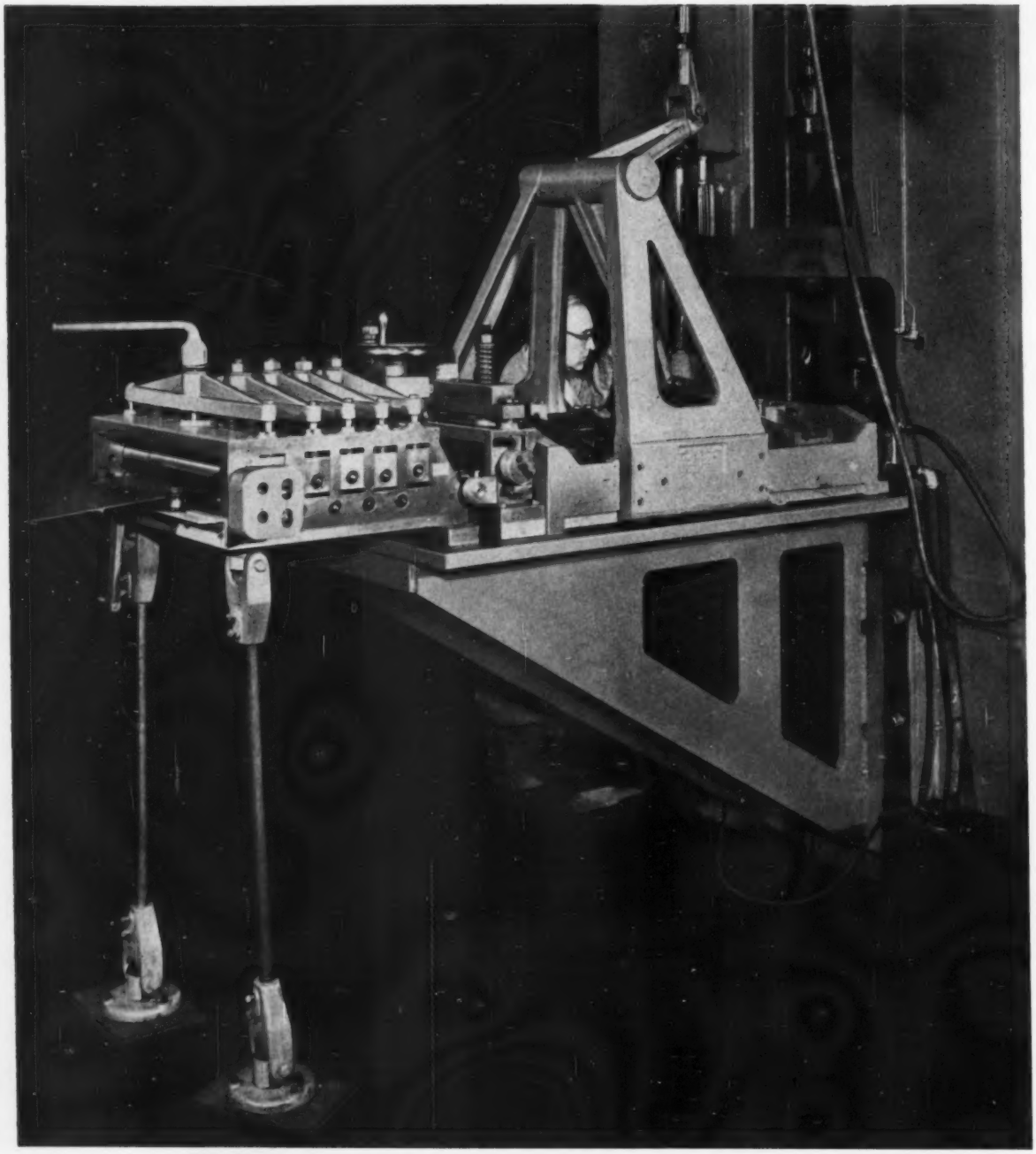
- new design box bed allows use of high production indexing rotary loader
- coolant, oil and valves outside bed
- automatic lubrication
- meets J.I.C. electrical and hydraulic standards
- automatic lateral location of work

LANDIS

precision grinders

LANDIS TOOL COMPANY / WAYNESBORO, PENNSYLVANIA

TEAMED FOR



SF-2424 U. S. Slide Feed with an SS-24-8 Plain straightener, mounted on a straight side press to feed from left to right. This combination is capable of handling stock up to 24" wide—maximum length of feed is 24".

US PRODUCTS

U. S. TOOL

Slide Feeds • Roll Feeds • Stock Straighteners • Stock Reels • Stock Oilers • Coil Cradles • Combination Cradle Straighteners • Combination Reel Straighteners • Wire Straighteners • Die Sets • Multi-Slides® • Multi-Millers®

PRESS ROOM EFFICIENCY

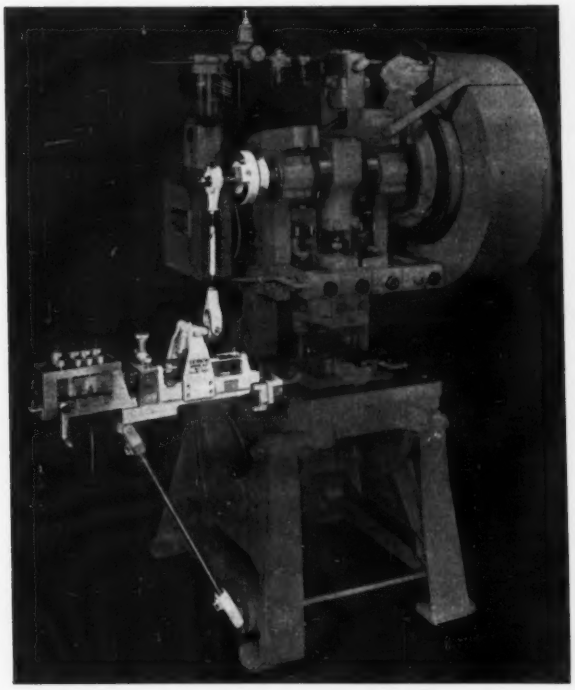
U. S. Automatic Press Room Equipment is made to team perfectly with your present presses. All units are engineered and built solely to increase the efficiency of your presses — to bring you the savings which result from the use of coil stock.

U. S. mechanical driven Slide Feeds have long been recognized by users as the most accurate automatic feeds on the market. They are built in a range of sizes with width capacities from 1½" up to 27", and all sizes can be teamed with matched Plain Stock Straighteners.

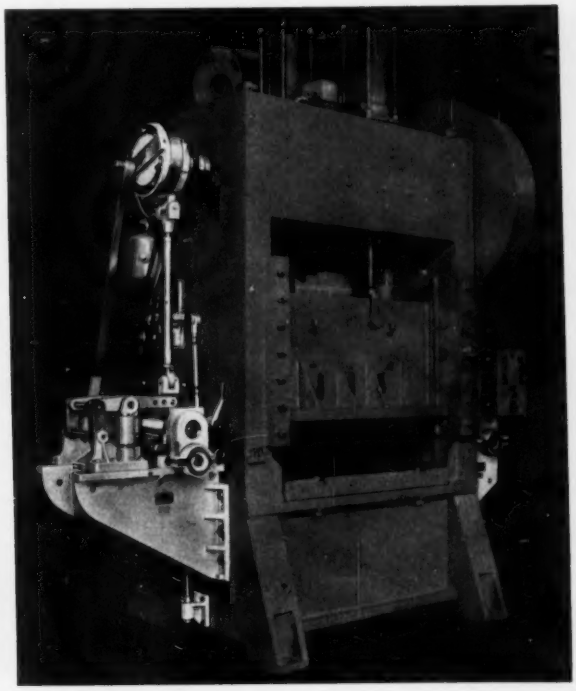
Where wire of round or irregular cross-section is to be fed, U. S. Slide Feeds are supplied with Two-way Wire Straighteners.

For certain applications, where roll feeding is desirable, U. S. Roll Feeds are available in either single or double types.

Whether you are working with .020" wire or wide flat stock, when you have U. S. equipment you have the perfect team for both short and long run jobs.



Model SF-1 U. S. Slide Feed with matching Plain Straightener, for stock widths up to 2½"— maximum length of feed 4".



Model RF-1212 U. S. Double Roll Feed (Racks and Pinion Type). Capacity: for material up to 12" in width, feed length adjustable up to 12".

Complete information about U. S. Automatic Press Room Equipment is yours by asking for Bulletin No. 85M

COMPANY, INC.

AMPERE *(East Orange)* NEW JERSEY

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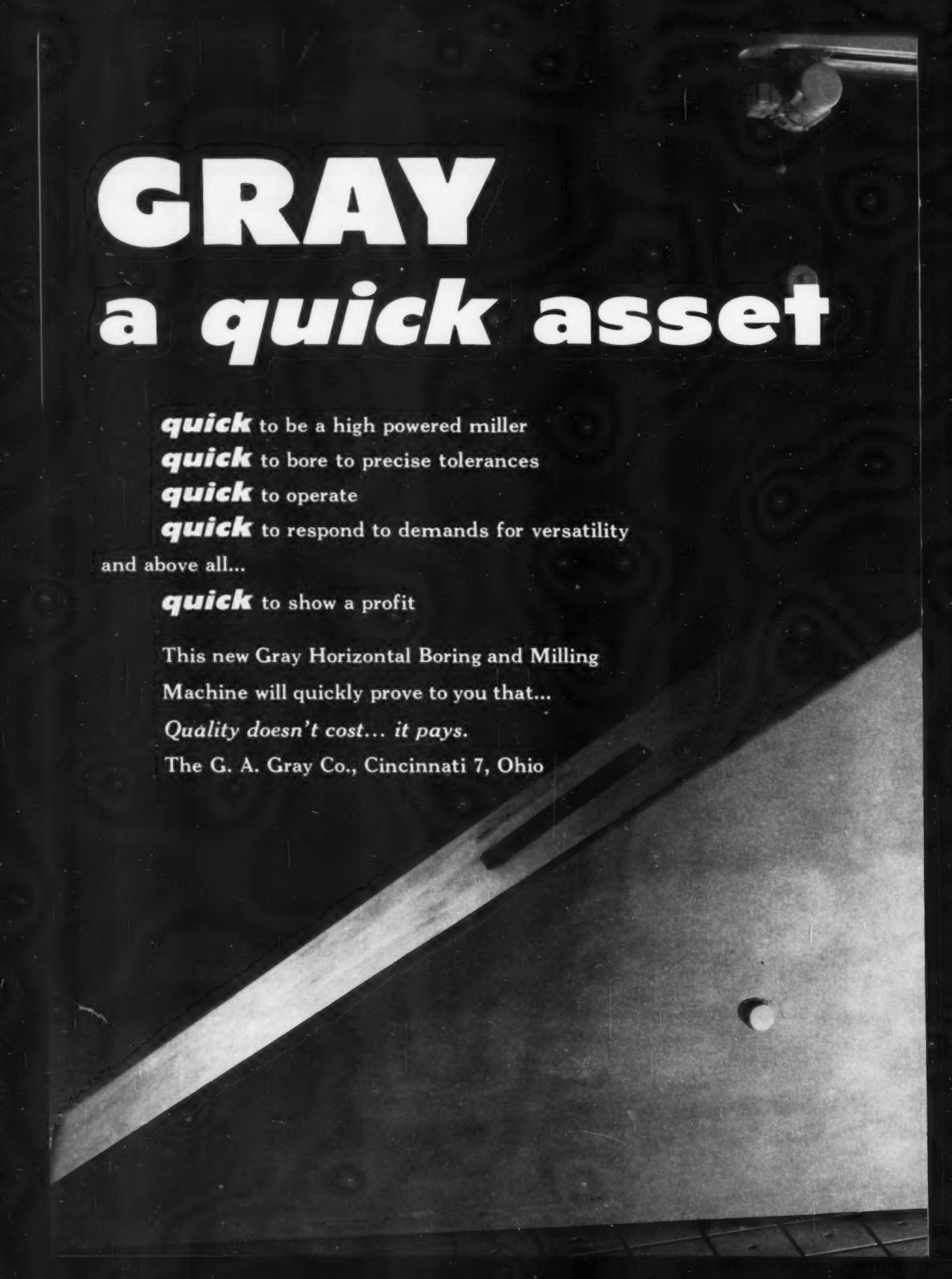
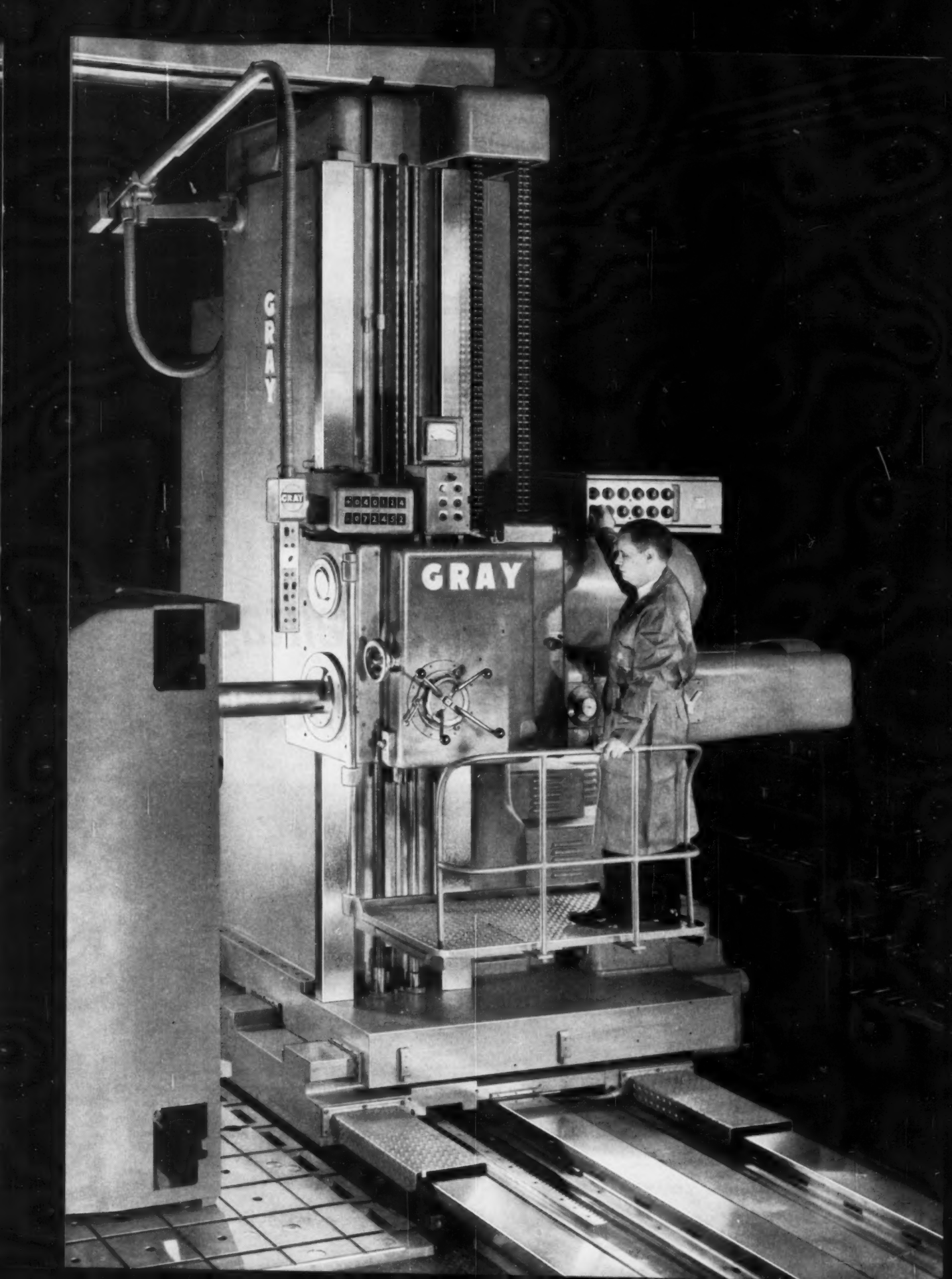

GRAY
a quick asset
quick to be a high powered miller
quick to bore to precise tolerances
quick to operate
quick to respond to demands for versatility
and above all...
quick to show a profit
This new Gray Horizontal Boring and Milling
Machine will quickly prove to you that...
Quality doesn't cost... it pays.
The G. A. Gray Co., Cincinnati 7, Ohio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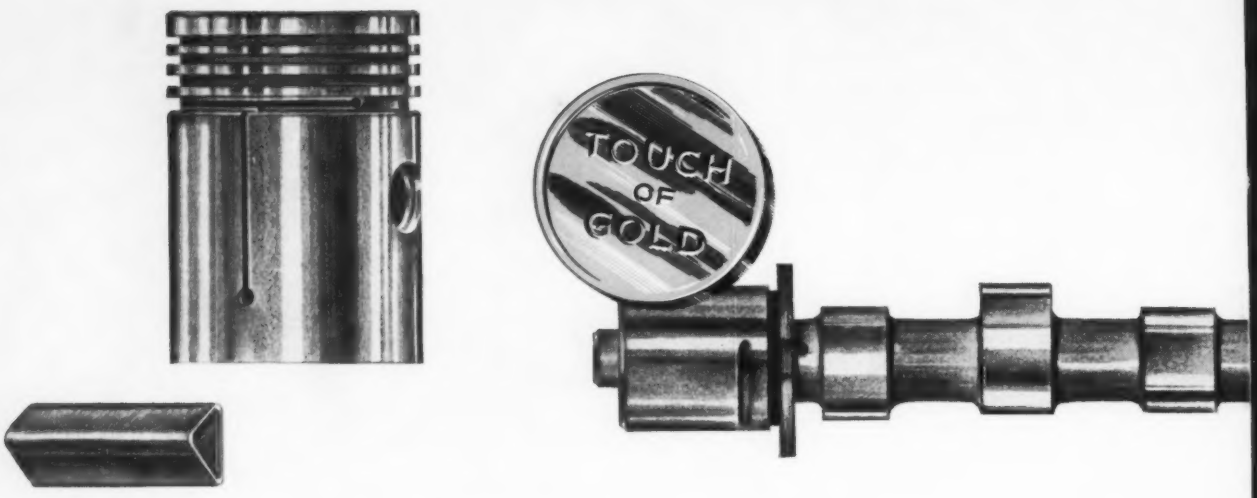
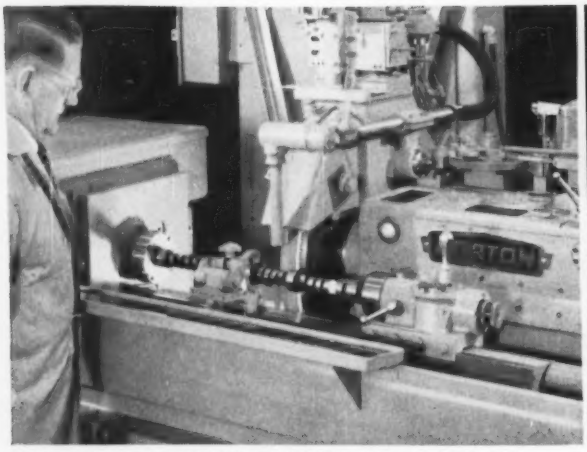
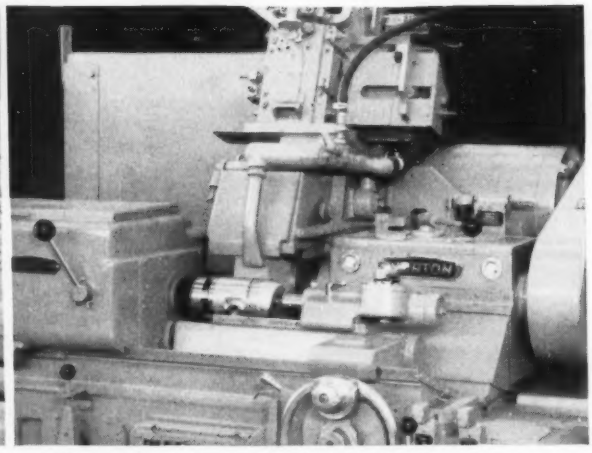


If you grind
special shapes . . . like these

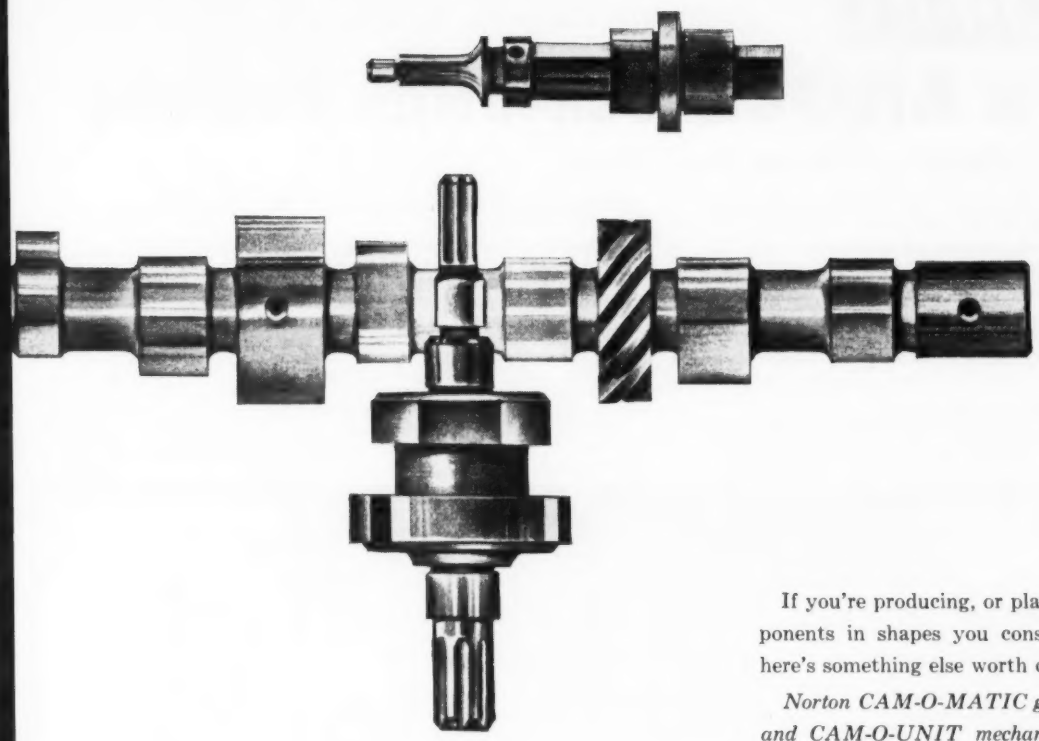
Check the special advantages of Norton grinders . . .



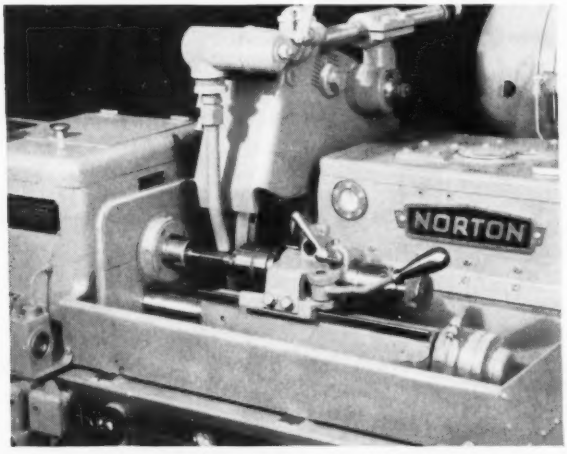
With a Norton No. 3 CAM-O-MATIC® Grinder, you grind all cams and the eccentric on an automotive-type camshaft automatically, in one handling. Automatic wheel truing and a patented device for grinding cam tapers in one or both directions are among the features that improve contour, finish and production rate.



A Norton 6″ x 8″ Semiautomatic Piston Grinder adds extra speed and economy to your grinding of elliptical pistons. Mechanism arrangements enable you to grind complex ovality into the skirt of a piston, as shown, or to produce standard ovality or different amounts of relief over a wide range.



. . . like these



Norton CAM-O-UNIT* Mechanisms, made in varying work capacities, are particularly valuable for extending the proved advantages of Norton CTU cylindrical grinders to the grinding of cams, elliptical pistons and many other forms. The CAM-O-UNIT mechanism shown is attached to a 6″ CTU to grind the three faces of a carbide tool bit.

If you're producing, or planning to produce, components in shapes you consider difficult to grind, here's something else worth considering.

Norton CAM-O-MATIC grinders, piston grinders and CAM-O-UNIT mechanisms are engineered to handle a wide range of cam and shape grinding . . . including endless variations of square, triangular, oval and many-sided forms . . . and to provide the exact forms and tolerances you need with fast, trouble-free performance that will lower your operating costs.

Shapes you can produce on this special grinding equipment include not only arcs but curves and tangent flats in combination. Your Norton Man, a trained grinding engineer, will be glad to give you expert help in selecting and operating grinding equipment that will bring you top-quality, low-cost results on the toughest jobs. NORTON Company, Machine Division, Worcester 6, Mass. District Offices: Worcester, Hartford, Cleveland, Chicago, Detroit. *In Canada:* J. H. Ryder Machinery Co., Limited, Toronto 5.

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NORTON

GRINDERS *and* LAPPERS

Making better products
. . . to make your products better

NORTON PRODUCTS: Abrasives • Grinding Wheels • Grinding Machines • Refractories • Electro-Chemicals — **BEHR-MANNING DIVISION:** Coated Abrasives • Sharpening Stones • Pressure-Sensitive Tapes

Progress Report

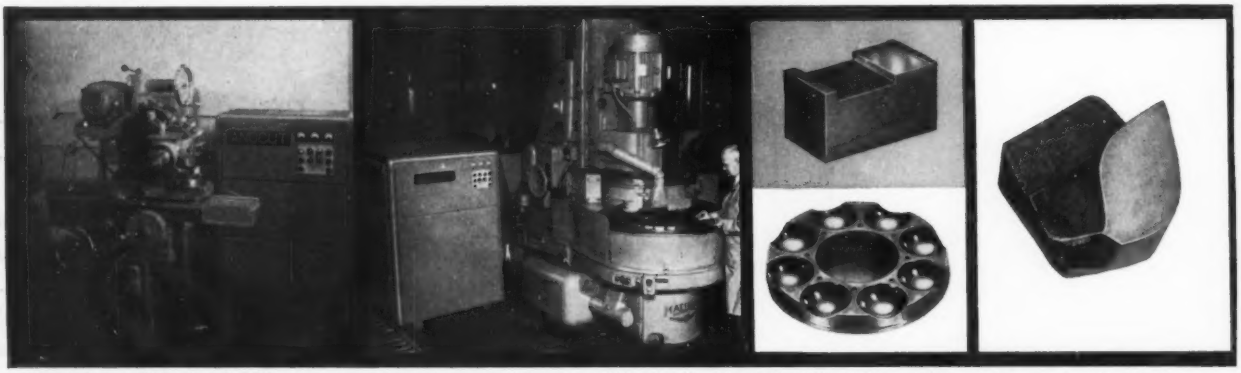
on ANOCUT™ Electrolytic Machining

INDIRECT COSTS—Hidden Gold Mine

Perhaps cost reduction programs, value analysis committees and the like have placed too much emphasis on reducing unit costs by modernizing and powering up production tools. Indirect costs-factory burden, has too often been a neglected area in such studies. Labor hours spent in reconditioning tools and cutters add dollars and cents to unit costs just as truly as do those of a turret lathe operator. Yet, the equipment and techniques used in many grinding cribs today are substantially the same as 20 years ago. This heretofore neglected area must also be up-dated and made competitive, and few if any areas in a modern shop or plant offer an investment opportunity as likely to produce such dramatic dividends. a forgotten gold mine of savings.

It's easy to talk about indirect costs. Here is what Anocut is doing about them.

- Abrasive costs reduced 80-90 per cent.
- No rejects due to heat checks or cracks.
- Reduces consumable tool purchases.
- Broken tools and "scrap" carbide reclaimed.
- Regrind throwaways for 10% of original cost.
- Excellent finish and no saw-tooth edges.
- "Push-button" grinding.
- Make form tools from standard blanks. No premium priced preforms.
- Grind carbide and steel simultaneously.
- Faster grinding on most grades.
- One grind only Separate roughing and finishing not required.



Regrinding carbide tipped milling cutter. Each tooth is plunge-ground on a face-type wheel to a positive stop. Cutter is then indexed and the next tooth is plunged to the same stop. Extremely low wheel wear allows cutter to be finished in one indexing, regardless of amount to be removed, resulting in substantial savings in abrasive costs and grinding time.

Single pass machining of carbide tipped milling cutter blades, removing carbide and steel simultaneously. Using Model 1500 ampere Anocut unit on Mattison vertical spindle machine, .005" to .008" of carbide is removed in a single pass. Abrasive costs are reduced 80 per cent, production increased, scrap virtually eliminated.

Slot ¾" by ¾" by .100" ground in hard carbide in one pass in 60 seconds. Electrolytic grinding offers fast, inexpensive method for bulk removal of carbide.

Eight spherical radii ground in 416 stainless piston pump part (35 R_C) 6-8 microinch finish, reducing machining time 40 per cent.

High speed steel tool. New higher powered supply units provide rapid removal and good finish on resharpening dovetail and circular form tools. Non-diamond wheel used.

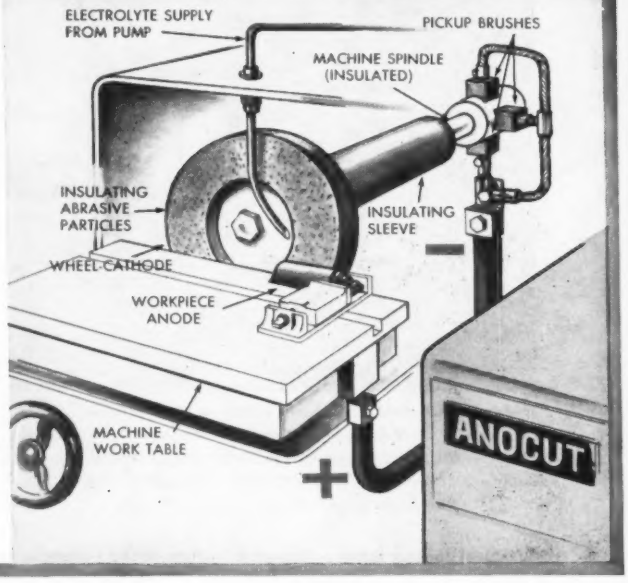
HOW IT WORKS

Electrolytic removal may be considered as the reverse of electroplating. The workpiece, which must be metallic, is made the anode in the circuit. The metal bonded abrasive grinding wheel is made the cathode. Short circuiting between the two is prevented by the protrusion of spacer abrasive particles from the surface of the wheel. A conductive water-base electrolyte fluid flows across the surface of the wheel, passing the current between the workpiece and the metal wheel. The automatically controlled direct current supplied by the Anocut unit causes the workpiece to dissolve without chips, as the abrasive particles of the wheel maintain size and finish.

Anocut Electrolytic Machining should not be confused with the spark-discharge or ultrasonic-impact methods. In the Anocut process, metal is removed by electrochemical action as in electroplating, not by arcs or sparks. The work is not immersed in oil, but is fed into the wheel just as in conventional machining.

Not magic, but an established scientific principle underlies Anocut Electrolytic Machining. The removal rate on any metal is in strict accordance with Faraday's Law, which states that the amount of metal removed is directly proportional to the number of amperes passed through the electrolyte fluid. If the number of amperes is doubled, the volume of material removed is doubled. The current which is passed is determined in large part by the area of contact between the wheel and the work. Hardness and tensile strength are not important. As a general rule, approximately .100 cubic inches of material can be removed per minute with each 1000 amperes. If 2000 amperes are passed, the removal will be doubled, to approximately .200 cubic inches. Accordingly, the wheel-work interface area should be maximized and every effort made to pass the maximum amount of current.

The electrolytic machining process, pioneered by Anocut is covered by U.S. Patent No. 2,826,540. Others pending.



From Alnico to Zircaloy...
Advantages and Limitations

Common soft metals, in most cases, can today be machined or ground fast and inexpensively, with no special problems. Anocut Electrolytic Machining is not recommended as a replacement for the grinding wheel or milling cutter on such jobs. But this new method of removing metal by electrolysis should be considered on any metal-removal application in which conventional methods create problems of abrasive cost, slow speed, thermal damage, burrs, layover or smear, finish, rapid tool breakdown, collapsing thin sections, maintenance of form, or size control.

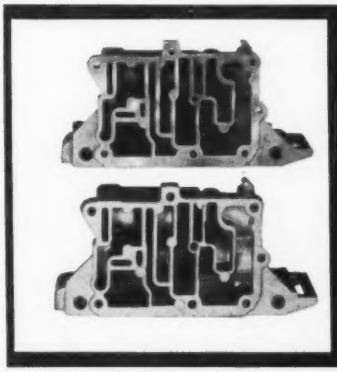
Because the bulk of the metal is removed by electric current flow you gain these advantages...

- Hardness or tensile strength have little effect on the removal rate.
- Wheel breakdown and abrasive cost per piece are drastically reduced.
- Unmachineable metals can be worked.
- Fragile or heat sensitive parts are machined with speed.
- Good finishes are obtained that are free of layover, smear and abrasive or cutter marks
- Tool costs are slashed.

Materials from A to Z, and many having only a number, are now being machined electrolytically. Tool and design engineers more and more are specifying harder and tougher materials, knowing that a practical method is now available for working them.

The leading machine tool builders listed below have assisted Anocut in introducing this new machining concept to industry. Some have complete lines of electrolytic machines; others offer their standard equipment with the necessary alterations incorporated. Still others have designed special equipment to take full advantage of the fact that Anocut now offers as standard equipment automatically controlled electrolytic supply units with output capacities of 50 amperes to 3000 amperes. Higher capacities, up to 120,000 amperes, are available on request. Leading abrasive manufacturers have also been of tremendous help in developing diamond and non-diamond wheels for all applications, replacing milling cutters in some cases.

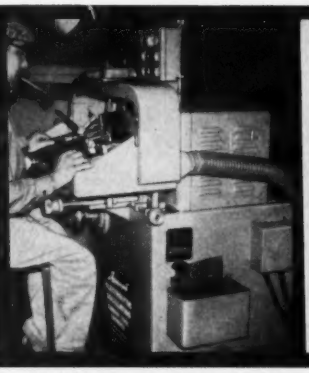
Anocut's sole business is the engineering of applications for this potent new metal removal procedure and the manufacture of electrolytic power supply units and electrolyte solutions



Aluminum die casting, faced against disc-type wheel to produce flat sealing surface. Raw and finished parts shown. Flatness held under .0005". Feed is .0015" per second. Current required is 1200 amperes. All edges are burr-free.

Leading and trailing edges of gas turbine bucket plunged against flat surface of disc-type wheel. An average of .100" removed in 25 seconds. No heat damage, and no burr.

Spot weld inspection. Nugget and tiny hole in center clearly exposed. This job previously done by slow etching and lapping procedure. Now done on Anocut Model 300 and face type wheel.



Model SCE-6, one of complete line of tool grinding machines made by Hammond Machinery Builders for Anocut electrolytic grinding. Wheel oscillates, table is mounted on ball bearing ways, MistKolector is incorporated, and air feed can be used for "push button" grinding.

Compound contouring of stainless steel honeycomb is now an accomplished fact. Sample shown is absolutely burr-free. Other production installations involving flat machining of this material have been operating successfully for years.

Front interior view of Model 300, showing placement of power components, fuse cutouts, and quick demountable control chassis for automatic voltage regulation.

WRITE ANOCUT OR ANY OF THE FOLLOWING

Abrasive Machine Tool Co.
The Blanchard Machine Co.
Besly-Welles Corporation
Brown & Sharpe Manufacturing Co.
Cincinnati Milling & Grinding Machines, Inc.
Covel Manufacturing Co.
DeVlieg Machine Co.
The DoALL Company
Ekstrom, Carlson & Co.
Ex-Cell-O Corporation
Frauenthal Division
Gallmeyer & Livingston Co.
Gardner Machine Company
Hammond Machinery Builders, Inc.
Mattison Machine Works
Norton Company
Onsrud Machine Works
Pope Machinery Corporation
Reid Brothers Co., Inc.
The Standard Electrical Tool Co.
The Thompson Grinder Company

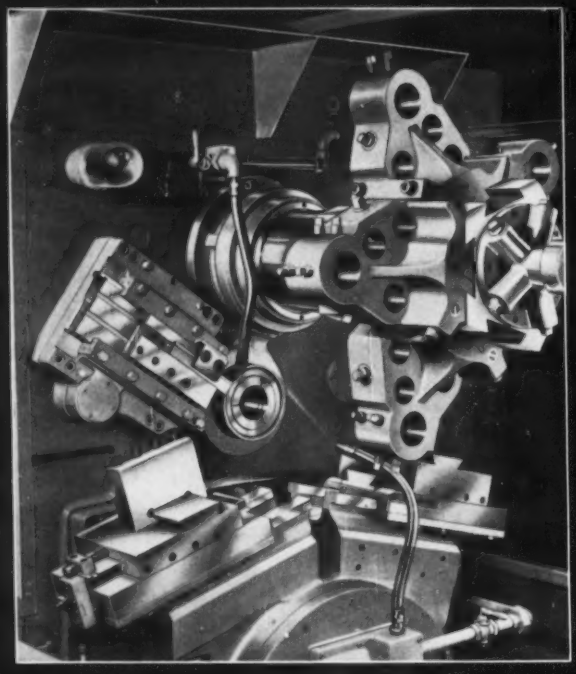
ANOCUT
ENGINEERING COMPANY

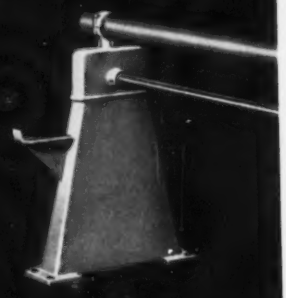
631 WEST WASHINGTON BLVD. • CHICAGO 6, ILL. • PHONE STATE 2-5480

For more data, circle this page number on inquiry card

NEW! WARNER & SPINDLE

...enables profitable small-lot production of even your most complex and precision-demanding bar jobs on a fast, automatic basis





This new 2AB machine has a 3-inch diameter bar capacity and a 9½" working stroke. A unique all-clutch speed transmission eliminates changing speed pick-off gears and provides two ranges of six automatically selected speeds: From 120 to 1544 rpm in the High Range, and 56 to 728 rpm in the Low Range. Right or left-hand threads can be cut from 7 to 32 tpi. Six automatically selected feeds are available from a 36 feed range (.0019" to .124") in addition to six independent cutoff feeds ranging from .0015" to .020".

Now, the shop-proven, cost-cutting features which have made Warner & Swasey Automatic Chuckers so outstanding in their field are available in a new Single Spindle Bar Automatic. Most important among the profit-producing features of this new Warner & Swasey 2 AB are:

● **FASTER SETUPS**—With no cams to change, time-consuming set-up procedures, usually encountered with automatic bar machines, are eliminated. Even your smallest lot bar jobs can now be produced economically on an automatic basis.

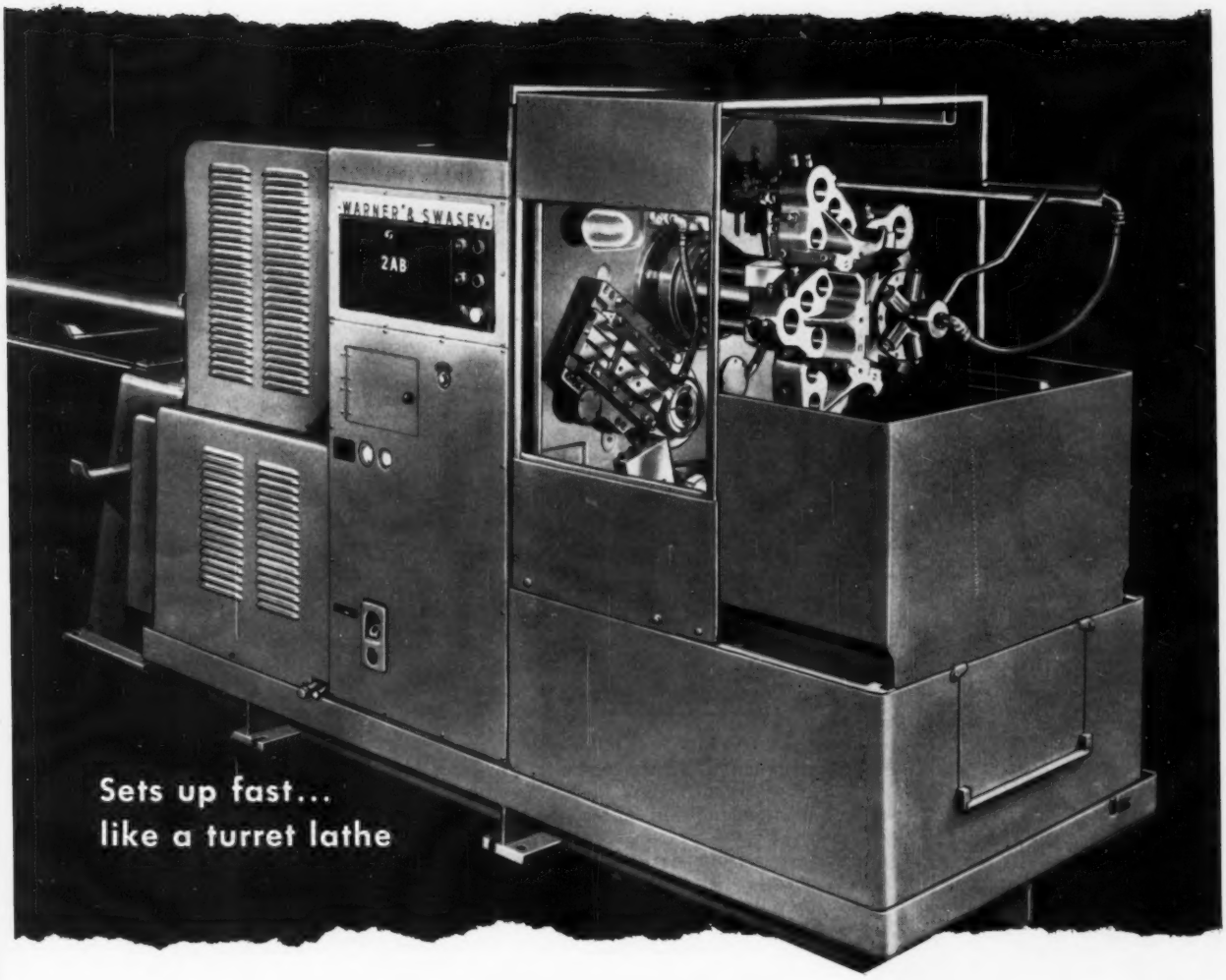
● **GREATER ACCURACY**—Only two wide—and widely-spaced—bearing surfaces support the turret. Thus, cumulative tolerance problems in conventional "multiple bearing" turret location designs are eliminated.

● **EASIER TOOLING FOR COMPLEX WORK** Flexibility and accessibility of the 2 AB's cross slides and pentagon turret enable the use of a wide variety of machining methods. One operation usually handles even the most complex workpieces.

● **POWER FOR TOMORROW'S JOBS—TODAY** The 2 AB's 25 horsepower, reversible motor more than meets today's rugged metal removing requirements and, coupled with a wide range of spindle speeds, permits the efficient application of the latest cutting tool materials.

● **"FREE" CUT-OFF TIME**—An independently-operated cut-off slide allows full utilization of both front and rear cross slides. The cut-off cycle may be started during

SWASEY 2AB SINGLE AUTOMATIC BAR MACHINE



any one of the pentagon turret stations. Thus, cutoff can be progressing during subsequent machining providing a cut-off cycle which is virtually "free".

● **AUTOMATIC RESTOCKING INDICATOR**—This ingenious device in the hydraulic bar feed mechanism automatically stops the 2 AB and lights an indicator light on the operator's control panel before the bar being machined runs out—prevents tool damage from improperly-gripped stock.

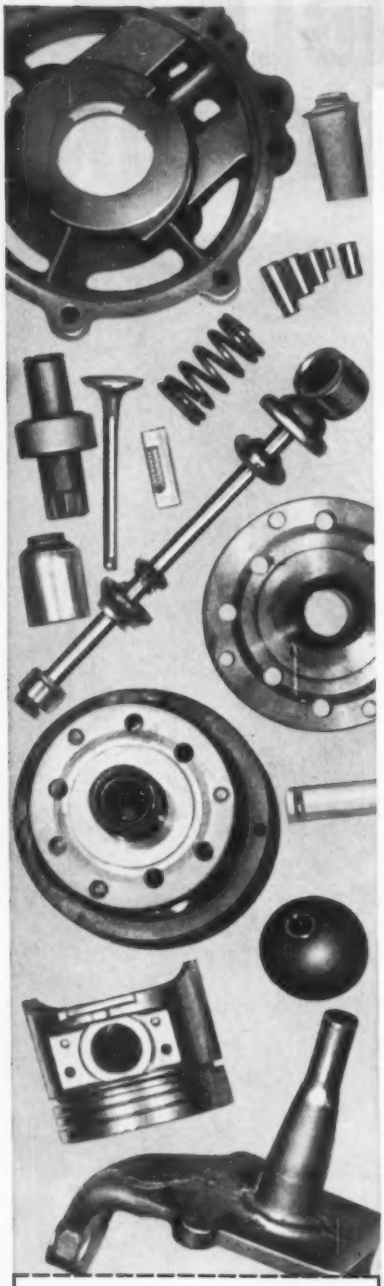
Why not call your nearest Warner & Swasey Field Representative and get the complete story on the new 2 AB. It can help increase both production and overall profits—so important in today's highly competitive picture.

WARNER & SWASEY
Cleveland
PRECISION MACHINERY SINCE 1880

NO MATTER WHICH WAY YOU TURN
...WARNER & SWASEY CUTS COSTS

For more data, circle this page number on inquiry card

..... practical automation ideas



Portable Demand-Feed Storage

For plants operating on a job-run basis, Gear-O-Mation has recently developed a number of portable storage units which can be quickly rolled into position at various machines to provide demand feed. One such unit has storage 'containers' for several sizes of parts. An important advantage: parts are protected against damage in handling into and out of storage and at the machine.

Simple Locating Shuttle

A simple walking beam device permits the quick shuttling of large castings from one machine or line to another, locating the part in the second machine automatically in the same motion.

Gear-O-Mation Division was organized in 1956 to develop and build highly practical automation equipment GEARED TO EITHER EXISTING OR NEW PROCESSES AND MACHINES—whether already in use or new.

Automated Handling of Fragile Parts

Fragile parts can be handled between operations without danger of injury by a conveyor with removable pallets. The pallets carry the work to the proper place and then return to the starting point on a separate conveyor. A typical use: manufacture of grinding wheels.

No Electrical Units

A combination parts-accumulator, storage device and demand feeder has no electrical connections or devices. Servicing of parts elevators, escape mechanisms, sensing devices, etc., can be be done with a couple of wrenches and a screwdriver. All controls and operating units are pneumatic.

It is the policy of Gear-O-Mation to use only proven mechanical, pneumatic, hydraulic or electrical devices in its automation equipment. This minimizes chances of service interruptions and insures minimum cost consistent with reliability and performance.

"Wash Just Before Use"

Demand-feed storage units can be combined with integral parts washers in such a way that parts can be cleaned as they go into storage or just before they come out, or both. Best practice seems to be: clean parts shortly before they pass on to the next operation.

The success of Gear-O-Mation's "simplicity" policy is attested to by the successful operation of Gear-O-Mation equipment in a wide variety of industries and both continuous or job-lot types of plants.

Irregular Parts Can Roll Too

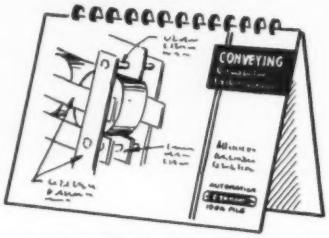
Parts that are notched and have a tendency to interlock can be fed by gravity without difficulty provided the proper chute angle is used. At Gear-O-Mation we don't depend on 'paper calculations' for this. 'Adjustable angle' gravity test chutes are used to find the best chute angle to avoid interlocking and yet feed parts at minimum rolling speed to avoid damage.

To automate you do not need to spend fortunes. Nor do you have to go in for complex electrical or electronic control. Frequently the simplest solution is the best. That's Gear-O-Mation's philosophy. Yes, we know, it often takes more ingenuity to do things simply rather than by complex devices. But that's our stock in trade—INGENUITY.

Cleaning-Up Boosts Output

Experience shows that where handling of parts is automated, the increased plant cleanliness alone tends to boost production more than would be expected from the automation alone. Some plants get increased output simply by "getting everything off the floor".

NEW "IDEA FILE"



Every Gear-O-Mation field engineer now carries with him an "Automation Idea File." It contains sketches and details of practical answers to many parts handling problems—orienting, feeding, positioning, conveying, distributing, etc. These ideas will suggest variations to suit your exact needs. Have a Gear-O-Mation field engineer go through the "Idea File" with you soon! Use the handy coupon at left.

GEAR-O-MATION
Division of Michigan Tool Company
7171 E. McNichols Rd., Detroit 12, Mich.

Yes! I want to see the time- and money-saving ideas in your new "Idea File." Have your field engineer show it to me soon!

Name_____

Company_____

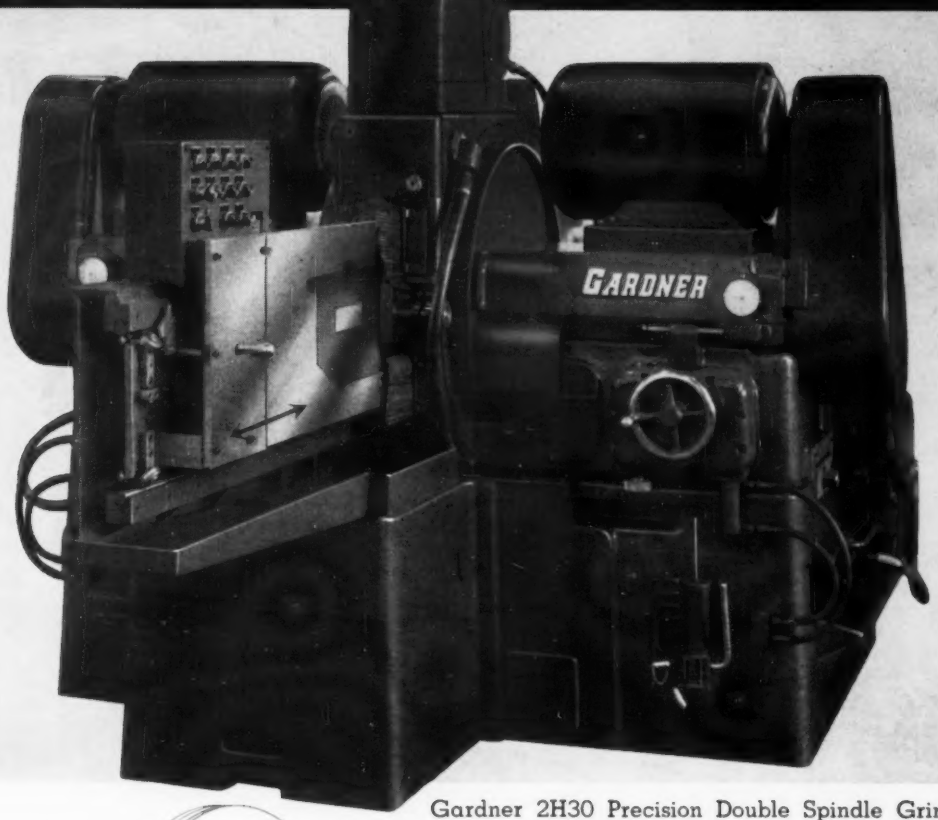
Street_____

City_____

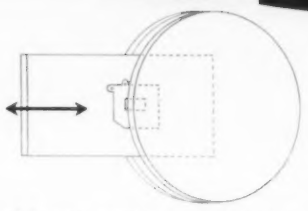
GEAR-O-MATION
DIVISION OF MICHIGAN TOOL COMPANY
7171 E. McNICHOLS RD. • DETROIT 12, MICH.

Gardner gun type fixturing lowers costs in grinding large area and odd shaped parts

surface grinds TWO sides parallel in ONE operation



Gardner 2H30 Precision Double Spindle Grinder with gun type fixturing.



Typical large parts ground with gun type fixturing:

clutch races, bearing cones, valve plates, separator plates, deposit box doors, pump rings.

Advantages of Gardner reciprocating gun type fixturing

- heavy stock removal
- work holding paddles easily interchangeable
- profitable for short runs
- tolerances for flatness, parallelism and uniformity to "tenths"

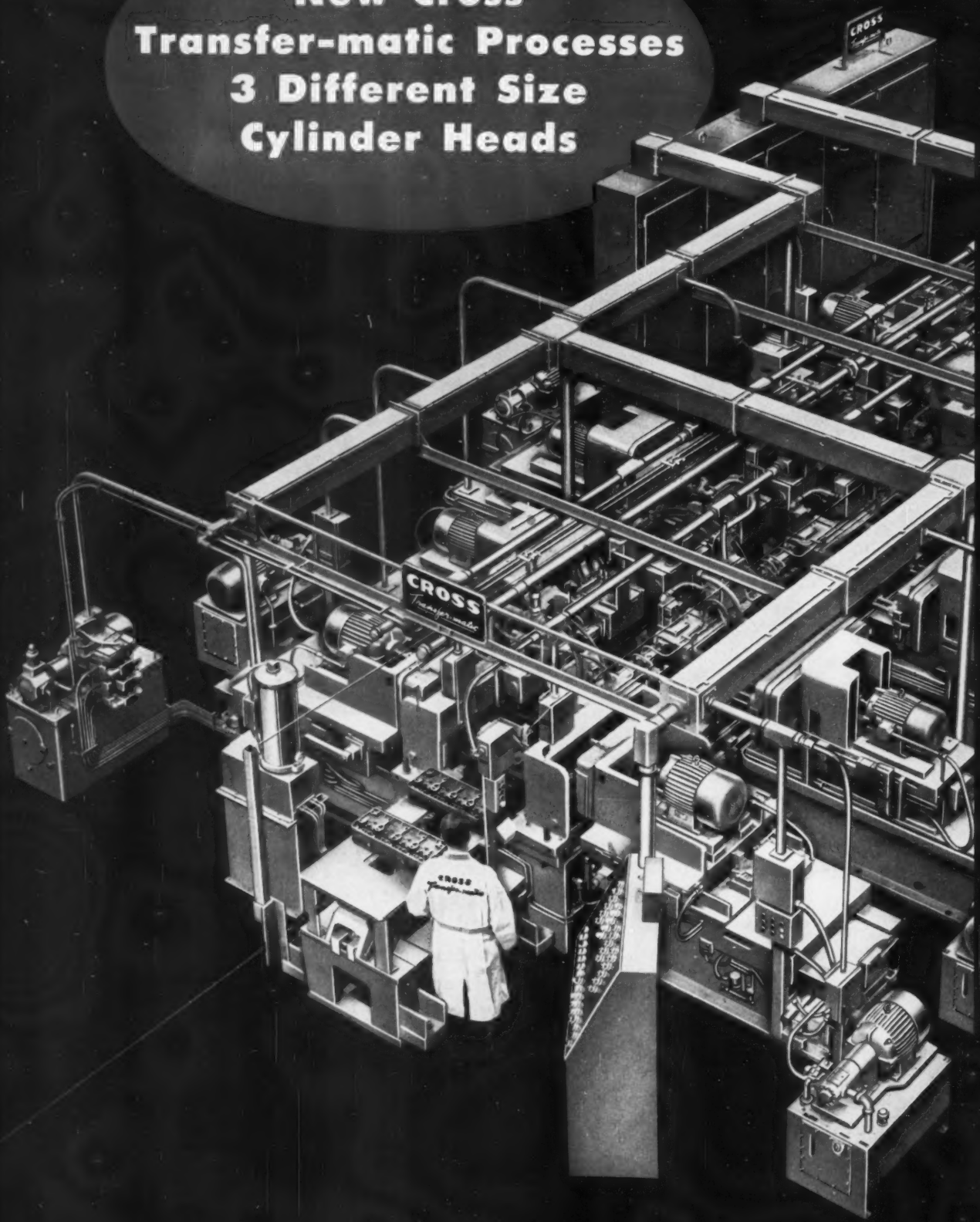
Ask the Gardner Man for practical recommendations or write for latest catalog.

GARDNER

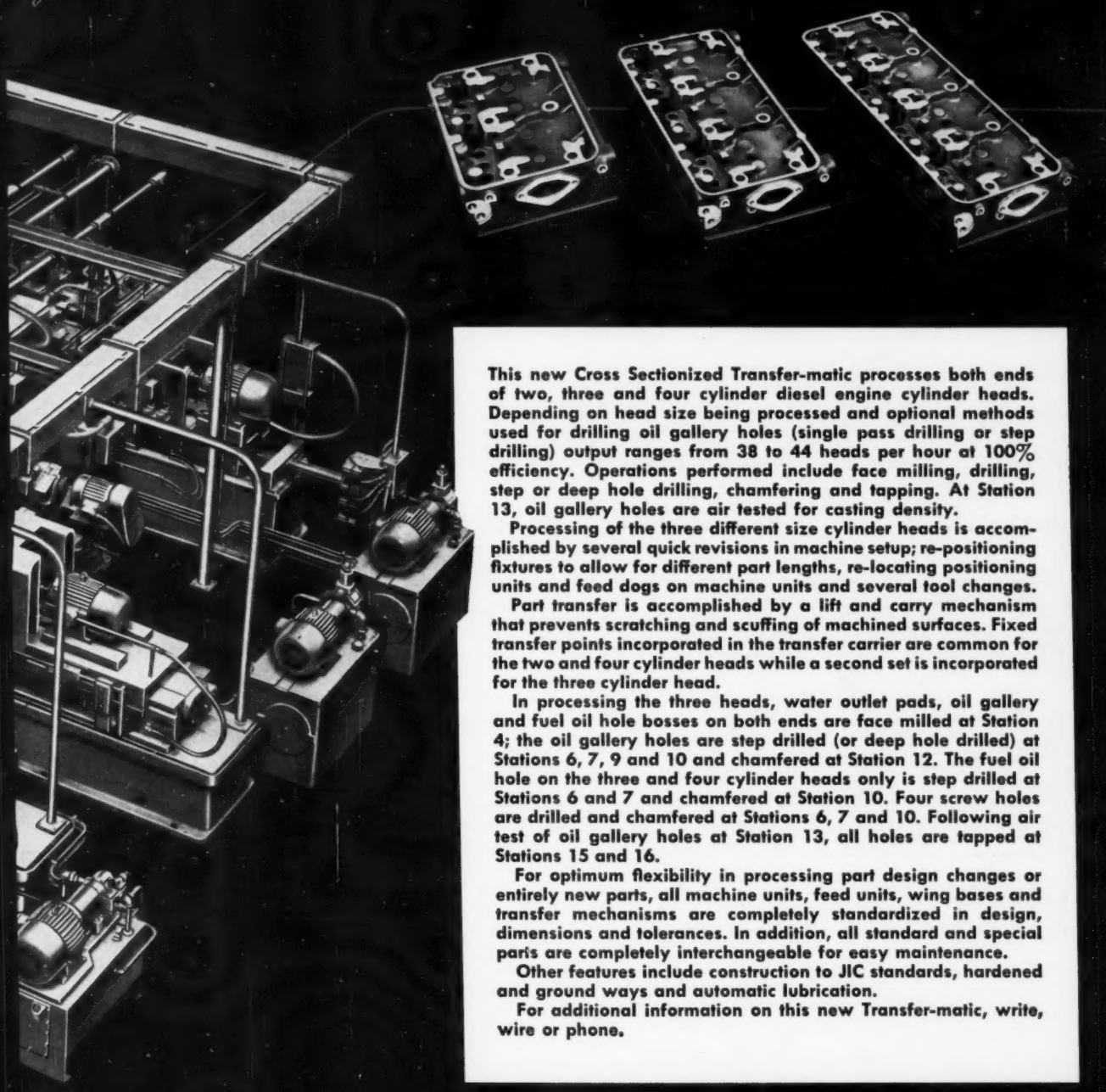
precision disc grinders

BELOIT, WISCONSIN

New Cross Transfer-matic Processes 3 Different Size Cylinder Heads



Another Automation First by Cross



This new Cross Sectionized Transfer-matic processes both ends of two, three and four cylinder diesel engine cylinder heads. Depending on head size being processed and optional methods used for drilling oil gallery holes (single pass drilling or step drilling) output ranges from 38 to 44 heads per hour at 100% efficiency. Operations performed include face milling, drilling, step or deep hole drilling, chamfering and tapping. At Station 13, oil gallery holes are air tested for casting density.

Processing of the three different size cylinder heads is accomplished by several quick revisions in machine setup; re-positioning fixtures to allow for different part lengths, re-locating positioning units and feed dogs on machine units and several tool changes.

Part transfer is accomplished by a lift and carry mechanism that prevents scratching and scuffing of machined surfaces. Fixed transfer points incorporated in the transfer carrier are common for the two and four cylinder heads while a second set is incorporated for the three cylinder head.

In processing the three heads, water outlet pads, oil gallery and fuel oil hole bosses on both ends are face milled at Station 4; the oil gallery holes are step drilled (or deep hole drilled) at Stations 6, 7, 9 and 10 and chamfered at Station 12. The fuel oil hole on the three and four cylinder heads only is step drilled at Stations 6 and 7 and chamfered at Station 10. Four screw holes are drilled and chamfered at Stations 6, 7 and 10. Following air test of oil gallery holes at Station 13, all holes are tapped at Stations 15 and 16.

For optimum flexibility in processing part design changes or entirely new parts, all machine units, feed units, wing bases and transfer mechanisms are completely standardized in design, dimensions and tolerances. In addition, all standard and special parts are completely interchangeable for easy maintenance.

Other features include construction to JIC standards, hardened and ground ways and automatic lubrication.

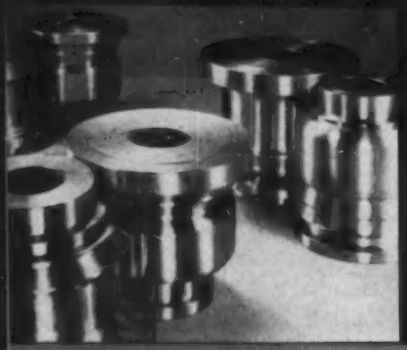
For additional information on this new Transfer-matic, write, wire or phone.

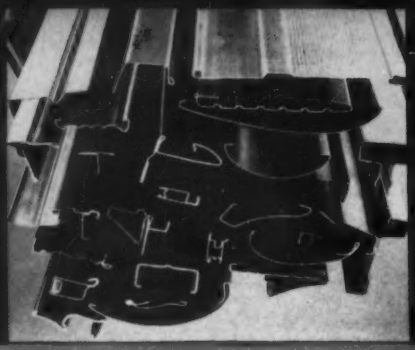
Established 1898

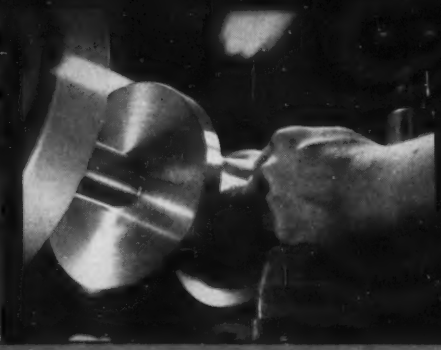
THE CROSS CO.

First in Automation

PARK GROVE STATION • DETROIT 5, MICHIGAN



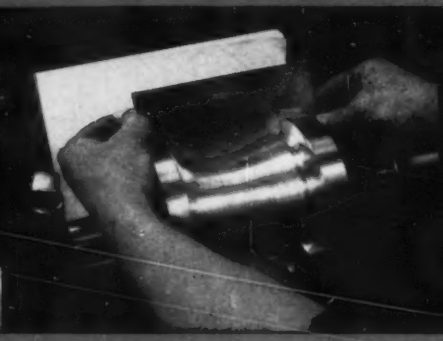




▶ Turning 3 to 20-stage rolls that . . .

▶ form automotive trim-molding is . . .

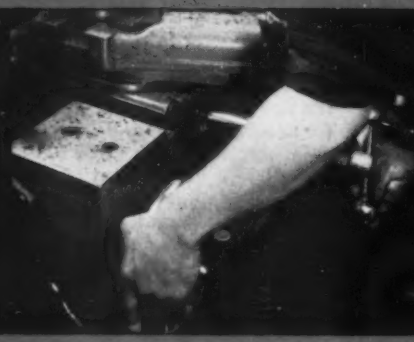
▶ a one-of-a-kind job of craftsmanship . . .



▶ checked . . .

▶ rescraped . . .

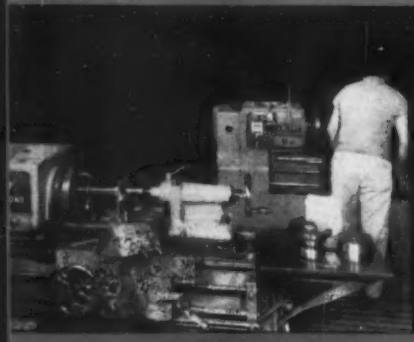
▶ and checked again . . .

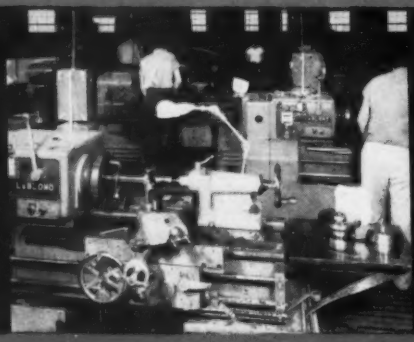


▶ Lathe craftsmen like these need . . .

▶ smooth, responsive controls . . .

▶ simple, convenient speeds . . .

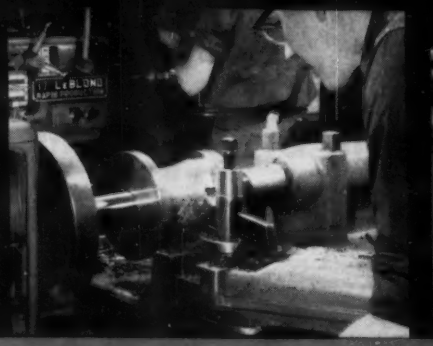


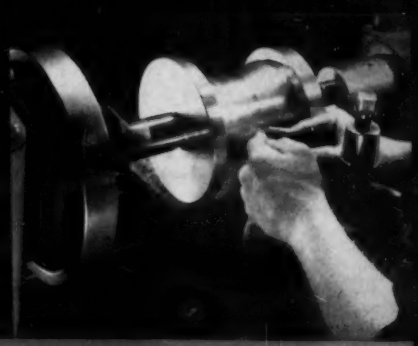


▶ bought 2 new LeBlond Rapid Productions . . .

▶ To work alongside their 3 LeBlond Dual Drives . . .

▶ while one other-make lathe sits idle!

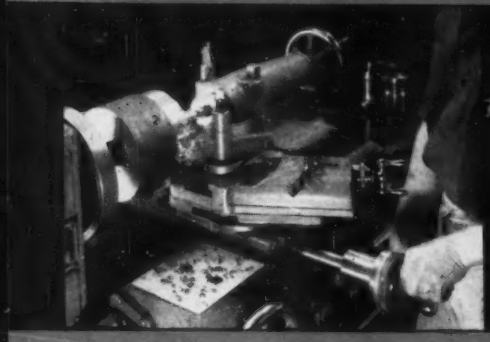


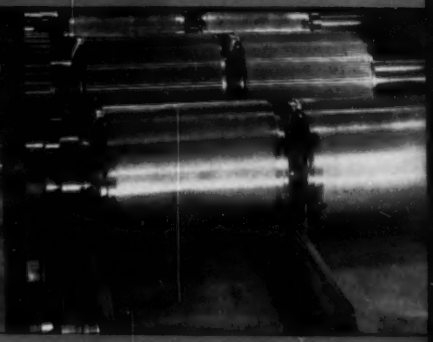


▶ First, females are roughed, then...

▶ turned to near-dimension...

▶ scraped with hand-held tool...

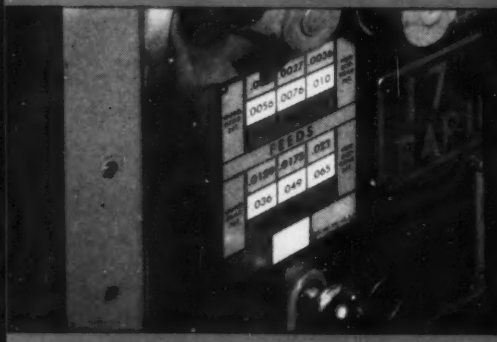


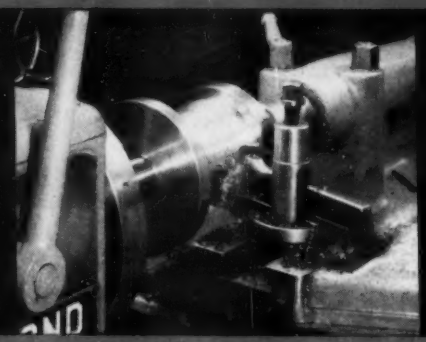


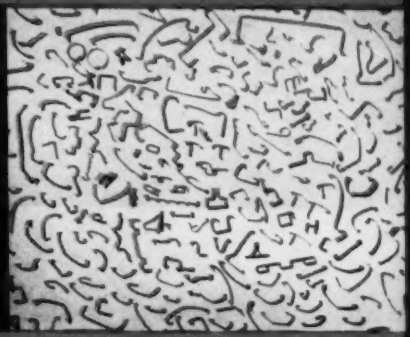
▶ Next, mating male is turned and scraped...

▶ checked with female using feeler gage...

▶ and final-checked in rolling mill...







▶ and feeds...

▶ power, and rigidity that lasts.

▶ That's why Dexter Roll Form Co., Detroit...

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▶ Remember, with turning craftsmen. it's LeBlond. Ask them.

NEW FROM FAIR STREET • HOME OF THE JIGMIL

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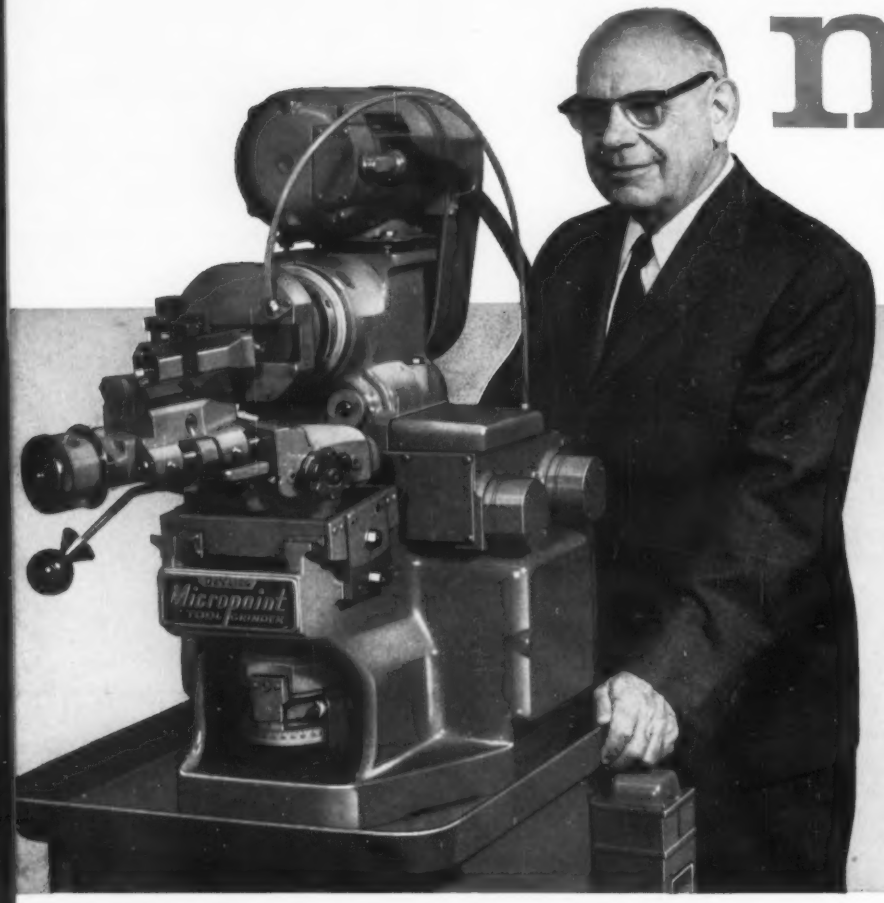
the first grinder



"Micropoint is the first machine in its field able to grind tool profiles geometrically correct to gage room accuracy"

"MICROPOINT is not just another grinder. It's a precision machine that makes possible a new technique of single point tool grinding. Advantages of this new technique include greater cutting tool life, increased accuracy and output of machine tools and greatly improved uniformity and finish of the end product. Originally developed for our own use, MICROPOINT became necessary in our continuing pursuit of accuracy."

C. B. DE VLIEG

DE VLIEG MACHINE COMPANY, FAIR STREET • ROYAL OAK, MICHIGAN

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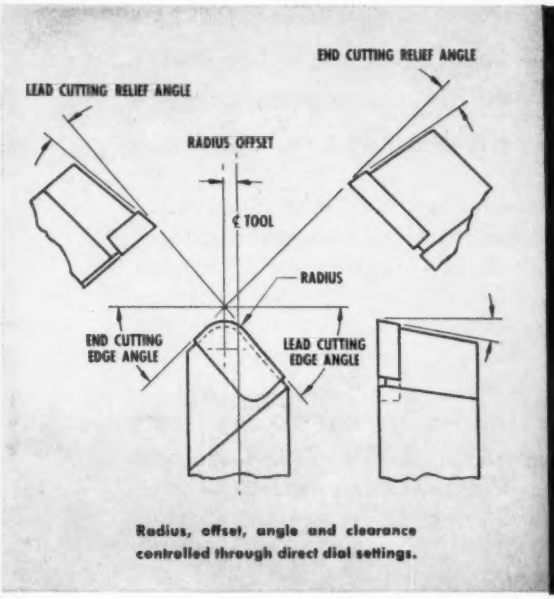
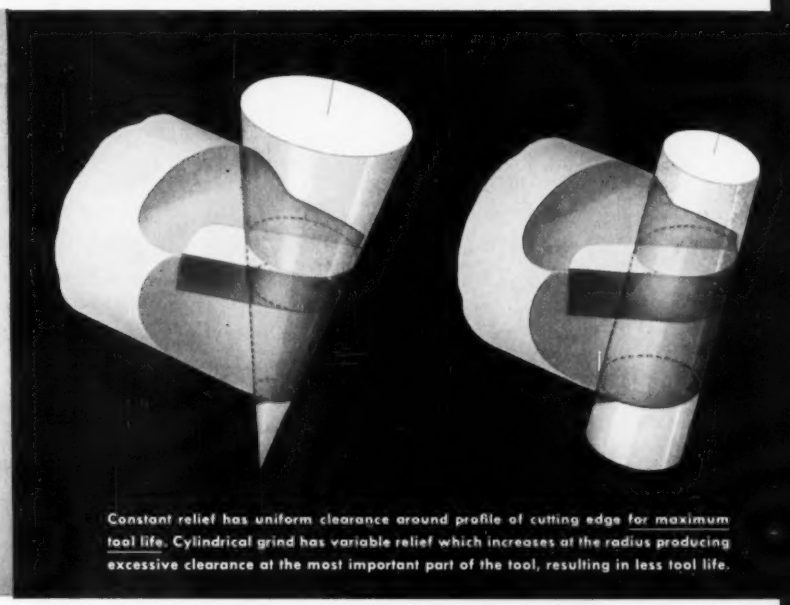
ropoint®

capable of absolute control of tool geometry



Radius, offset, angle and clearance controlled through direct dial settings.



Constant relief has uniform clearance around profile of cutting edge for maximum tool life. Cylindrical grind has variable relief which increases at the radius producing excessive clearance at the most important part of the tool, resulting in less tool life.

DIRECT DIAL SETTINGS reduce the possibility of human error and provide a method of fast, simple, accurate adjustment for each radius, angle, offset and clearance in exact accordance with the geometric requirements of the tool. With a minimum of operator training, tool profiles can be controlled to .0001". Set-ups can be made quickly and with precise accuracy. Operators have ground as many as 300 identical tools in one set-up without corrective adjustment. Because of the machine's unique design, diamond wheel cutting life has been increased 4 to 6 times. Field tested for three years, many MICROPOINT grinders are already in use throughout industry. Available from your DeVlieg distributor.

Write for Micropoint Tool Grinder Catalog

REWARDING REVELATIONS IN PRECISION AWAIT YOUR VISIT TO FAIR STREET

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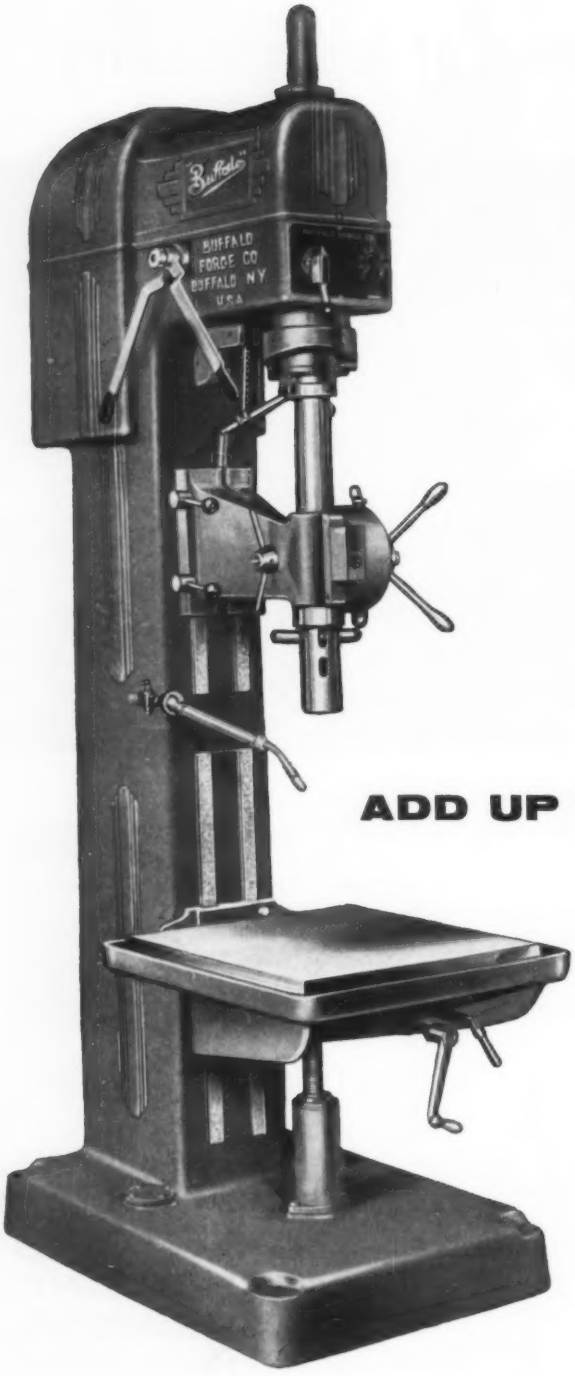
MICROPOINT® TOOL GRINDER

Geometrically correct tool points ground to gage room accuracy!



ADD UP THESE FEATURES AND

NEW "BUFFALO" R-P-Msters With Greater Capacities and Torque Controlled Feed

The first and best variable speed drilling machine brings you important new improvements. One is higher capacities. "Buffalo" R-P-Msters are now available for up to 2" in mild steel. Another is exclusive "Buffalo" Torque Controlled Power Feed. With the new R-P-Msters you can now safely use maximum speed and feed for the size hole being drilled. No need for worry about damage to drill or machine gearing. This torque control on the feed shaft positively eliminates danger of overloading the machine.

Moderate prices give you more drill value than ever in the new R-P-Msters. But you must try the new

R-P-Mster for yourself. Only then will you realize how smooth and easy to operate a drill can be. Rugged "Buffalo" construction insures long life with minimum maintenance.

For maximum accuracy in high-speed production drilling and tapping, investigate the new "Buffalo" R-P-Msters. Use coupon below.

"BUFFALO" No. 16 Drilling Machine

Check these top-value features of the "Buffalo" No. 16:

- 6-Spline Alloy Steel Spindle
- 5-Speed V-Belt Drive
- All-Geared Power Feed
- Hardened Tool Steel Clutch Members
- Hand-Scraped Table Ways
- Easy-to-Operate Table Raising Screw

Capacity is ⅞" in mild steel. Husky construction assures long, dependable life. Available in bench, floor and pedestal types. Multiple units up to 6 spindles. Options include power feed, motor reverse tapping and other attachments. See how the "Buffalo" No. 16 Drill can cut your drilling costs. Send coupon today.

"BUFFALO" NO. 18 Drilling Machine

These sturdy drills are ideally suited to multiple operations in heavy production runs. Capacity is 1" in cast iron. There are 19 models of the "Buffalo" No. 18 Drill.

YOU'LL PROBABLY SELECT A "BUFFALO"

One is sure to fit your job to a "T". Choose from bench, floor and pedestal models or multiple units up to six spindles. A full range of accessories is available.

The "Buffalo" No. 18 is easy to operate, easily adjusted. Quick setup changeovers mean more production time. Accuracy, versatility and durability are unsurpassed. Six-spline alloy steel spindles turn in 2 sets of precision ball bearings. This assures continued smoothness of operation without deflections.

See how the "Buffalo" No. 18 Drill can step up your production. Send coupon at right, or contact your "Buffalo" machine tool dealer.

BUFFALO FORGE COMPANY
Buffalo, New York

Please send me complete facts on the "Buffalo" Drilling Machines checked:
☐ R-P-Mster ☐ No. 18 ☐ No. 16

NAME _____ TITLE _____
FIRM _____
ADDRESS _____
CITY _____ ZONE _____ STATE _____

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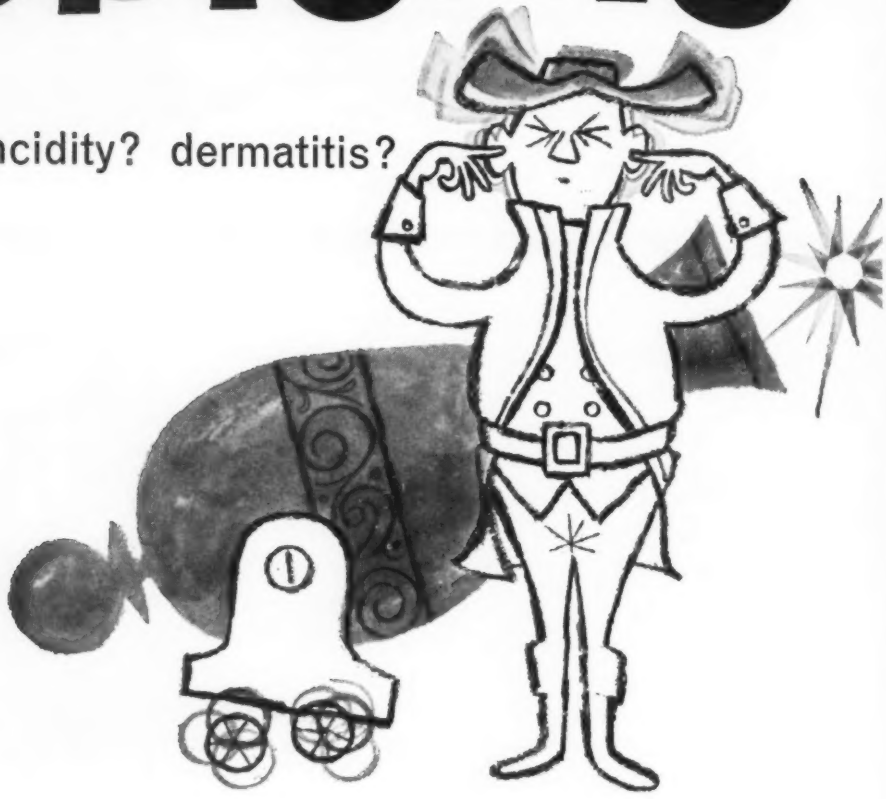
coolant problems

rust? rancidity? dermatitis?



Cold Stream stops rust resists rancidity reduces causes of dermatitis These problems start when your coolant gets dirty. Cold Stream stays clean week after week—even on cast iron. Cold Stream gives longest tool life. Finest finishes. Highest speeds and feeds. Best dimensional control. Cold Stream gives you everything you ever expected in a coolant!

JOHNSON'S

cold stream

Stays clean week after week and gives you all the performance you pay for.

JOHNSON'S WAX

For information, see your local Johnson industrial distributor.

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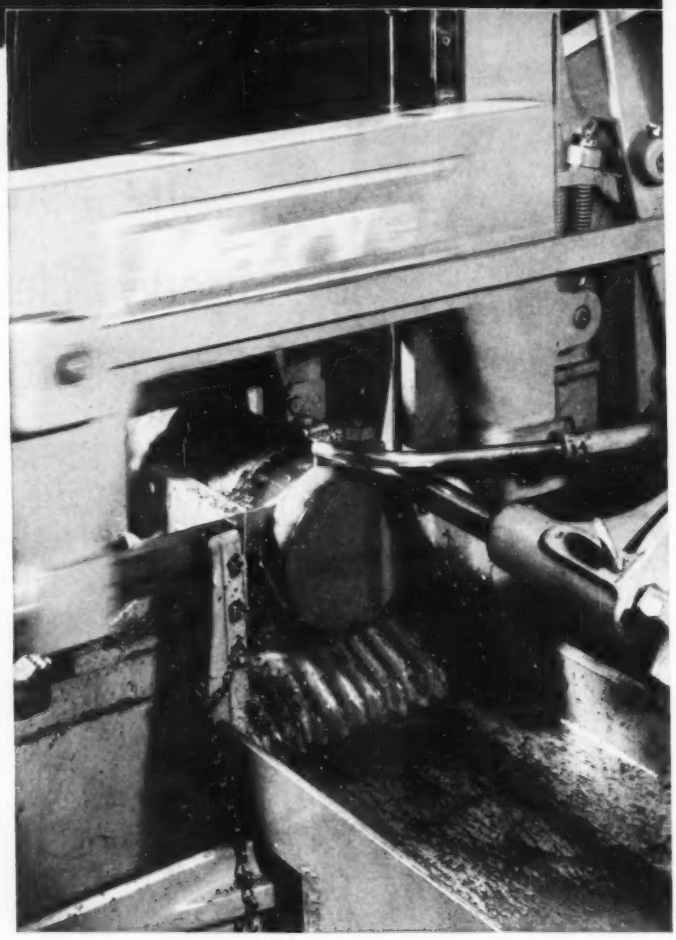
5 Basic Reasons why MARVEL HACK SAWS CUT-OFF MORE ACCURATELY...

The consistently accurate performance of MARVEL Heavy Duty Hack Saws is no accident. MARVEL engineers knew, many years ago, that to produce and maintain accurate cutting-off, a hack saw must be designed and built like a fine machine tool.

Some of the basic design principles built into the modern MARVEL Hack Sawing System that makes it the most accurate cutting-off method you can use are:



1. V-Way Design...Greater Rigidity

Upright and Saddle are precision machined and fitted to form a rigid, integral unit capable of withstanding any cutting load with no deflection or side movement.

2. Anti-Friction Bearing Construction

Anti-friction ball or roller bearings are used at all load carrying points. Even the strongly braced saw frame reciprocates on heavy duty, fully enclosed preloaded ball bearings which provide permanent, frictionless rigidity and true-running, straight line cutting strokes.

3. Minimum Blade Frame Reach

Close-coupled design and crank lever action of MARVEL Saws keeps the saw frame and blade reach very short in relation to the vertical V-ways on which the unit is mounted. This insures optimum rigidity, even under the most severe operating conditions.

4. Positive Relief Blade Lift

On the return stroke, positive relief lift raises the blade to provide proper and "cushioned" lead-in on the next cutting stroke. This prolongs blade sharpness, life and accuracy.

5. Rigid Cutting Tool

Cutting-off accuracy requires a rigidly held, relatively short cutting tool. MARVEL Unbreakable High-Speed-Edge Hack Saw Blades, which combine a narrow high speed steel cutting edge permanently welded to a tough alloy steel body, can be tensioned from 200% to 300% more taut than ordinary blades. This provides a most rigid cutting edge.

Catalog C85 has complete details, facts and figures on both Marvel metal cutting Hack Saws and Band Saws. Write for it today.

MARVEL *Metal Cutting* SAWS
Better Machines-Better Blades

ARMSTRONG-BLUM MFG. CO.
5700 W. BLOOMINGDALE AVE., CHICAGO 39, ILL.

PRODUCTION POINTERS from GISHOLT

More cost-cutting IDEAS– to help you

NEW HS BALANCER SAVES, UPS ACCURACY FOR BARBER-COLMAN

Simplifies balancing of small high-speed, lightweight work

This setup at Barber-Colman Company, Rockford, Illinois, will show you how to cut balancing costs and improve accuracy on miniature high-speed work.

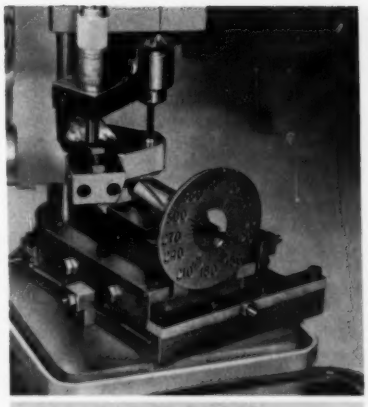
The workpiece, an aircraft control motor armature assembly, weighs 2¼ oz., operates at 13,600 r.p.m. Bearing movements must not exceed 0.000050″. Unbalance is corrected by drilling at the 0.245″ O.D. radius, in two transverse planes only ½″ apart.

All requirements are easily met on a new Gisholt HS-1 Balancer. Work is placed in a special fixture and is driven by a rubber belt on the O.D. The operator notes the angle and amount of unbalance in both correction planes. Next, he places the work in a correction drilling fixture. To correct in each plane, he adjusts a micrometer stop to the depth indicated by the amount meter. The part is oriented angularly by reference to a 360° protractor, and correction is made. A suction device removes all chips. Since drilling is permitted only in the lands, correction cannot be made at the exact angle in all cases and a second run may be required. Up to 15 parts per hour are measured, corrected and inspected for balance with this setup.

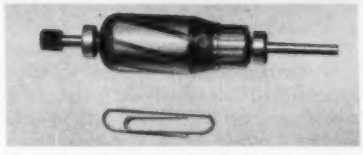
A complete line of high-speed (HS) bench-type balancers (horizontal and vertical models) is available for workpieces from ½ to 8 oz. or from 8 oz. to 10 lb. Belt-, air- or electrically self-driven parts or assemblies containing high-speed rotating parts such as miniature armatures, aircraft and missile gyros, small spindles, turbines, etc., are easily handled. Unbalance causing work support movements greater than .000002″ can be accurately measured and located with the work rotating at any speed between 1000 and 3000 r.p.m. or between 4000 and 12,000 r.p.m.

As on all Gisholt Balancers, operation is simple and does not require skilled personnel. Regardless of workpiece weight or method of drive, unbalance can be accurately measured and located in two transverse planes, as little as ¼″ apart, with unbalance indications in one plane completely unaffected by unbalance in the other. Accuracy is not affected by extraneous vibrations or electromagnetic disturbances, including those set up by electrically self-driven assemblies.

For more information on the NEW Gisholt HS Balancing Machines, contact your Gisholt Representative or write for literature —Form No. 1207.



Correction drilling fixture built by Gisholt to meet accuracy requirements of work. Micrometer stop adjusts to indicated drill depth; 360° protractor speeds angular orientation.



Close-up of armature assembly, weighing 2¼ oz., compared to standard paper clip.

Close-up of armature assembly in special fixture that permits balancing on its own bearings. Note photocell at right, triggered by angular reference mark on work, used to energize angle meter.

Accessory equipment for this setup includes a separate direct-reading angle meter and correction drilling equipment. Corrections may be made in two transverse planes, as little as ¼″ apart, to full machine accuracy.

HOW MACHINE SPECIALTIES CUTS COSTS ON JOB-LOTS

JETracer and automatic drive team up to speed machining

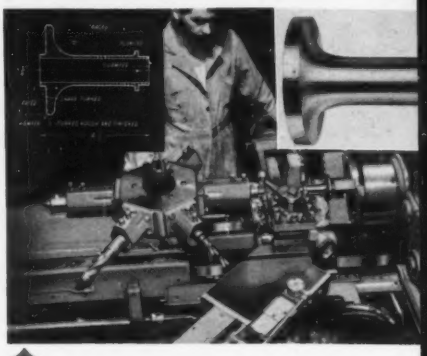
Doing job-lot work requiring close estimates and minimum equipment investment? Then you'll want to study this setup at Machine Specialties, Chicago, Illinois. It saves time and improves accuracy and finish on steel outer flange support castings.

Two MASTERLINE No. 5 Ram Type Turret Lathes are used. Both machines have automatic drives to provide automatic chucking turret lathe efficiency. One has a JETracer, mounted on the rear of the cross slide, to simplify machining of the O.D. contours.

The parts are machined in 100-piece lots in three operations. The first operation setup is shown. Work is held in an air-operated fixture, chucking on the rough flange O.D. Hex turret tools, controlled by the automatic drive, center-drill, drill halfway through and chamfer the bore. Automatic cycle holds while a form tool on the front of the cross slide forms a radius, and the JETracer is used to generate the O.D. contour and face the end. Time, just 7.0 minutes f.t.f.

The other end is machined and the bore is finished on the second automatic drive-controlled No. 5 in only 7.0 minutes, f.t.f. Then the parts go back to the JETracer-equipped lathe where the O.D. contour is finish-traced, to a 125 micro-inch RMS finish, and the radius is finish formed from the front of the cross slide, in only 2.5 minutes, f.t.f.

Automatic drive permits more accurate cost estimates, eliminates chance of human error, provides consistent quality and maximum tool life. JETracer simplifies O.D. contour machining. Operator handles two machines boosting production, cutting costs.



Automatic drive controlled No. 5 ram with JETracer on rear of cross slide. Automatic cycle performs standard machining from hex turret. Cross slide used separately to plunge form from front and trace from rear.

PRODUCTION INCREASED 400% WITH CENTER-DRIVE SUPERFINISHER

Special Superfinisher cuts handling time and saves floor space

Here is another case where a Gisholt Superfinisher not only takes a substantial bite out of production costs, but improves accuracy and concentricity as well.

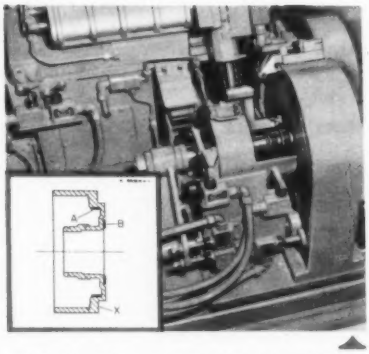
The job: producing a controlled finish in the piston bore and on the opposite thrust face of cast iron transmission clutch piston cylinders. Normally, to meet production requirements, four manually operated machines would be used. Here a special center-drive Superfinisher handles both surfaces simultaneously in one fast, automatic cycle.

Basically the machine is a standard Gisholt Model 51-A General-Purpose Superfinisher. A hollow, center-drive spindle, with a holding fixture, is mounted at the center of the bed casting. The workpieces are "banked" in a loading chute. They roll by gravity into clamping position. A loader at the spindle left, "pushes" the work into the center-drive fixture, locating against face X. Sufficient pressure is maintained to clamp the work during Superfinishing.

A stone-carrying quill above the loader moves down, over into the bore, then up, to Superfinish diameter A (from 125-300 to 15 micro-inches RMS, removing .001″ of stock or less). At the same time a cup-stone on a separate motor driven rotating quill at the spindle right, Superfinishes thrust face B (from 200-300 to 15 micro-inches RMS, removing from .002″ to .003″ stock).

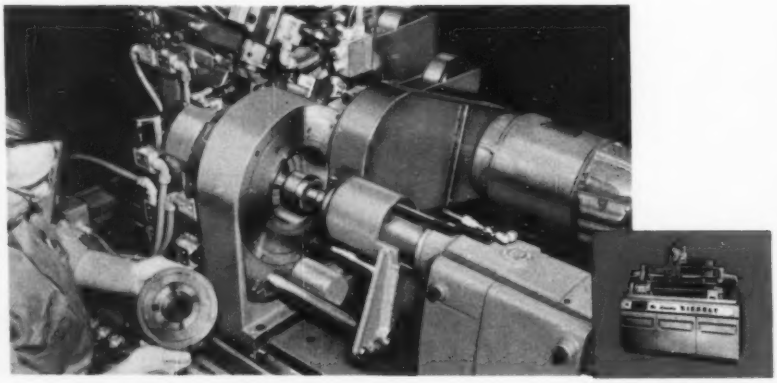
At cycle end, the loader retracts, tripping an ejector causing the work to fall into an unloading chute. The chute tips, rolling the finished part onto an outgoing conveyor. Time, from parts bank to outgoing conveyor, just 21 seconds.

Special Gisholt 51-A Center-Drive Superfinisher completes critical piston bore diameter and opposite thrust face in one chucking—improving quality, concentricity and cutting handling time 75%.



Critical surfaces on both sides Superfinished in one operation. Here stone-carrying quill about to engage piston bore diameter. (Stone life—400 to 450 pieces.) INSET—workpiece showing surfaces handled.

Cup-stone Superfinishes thrust face. (Wheel life of 200 to 250 pieces.) Note load and discharge chutes at upper right and rear.



HOW A. O. SMITH CORP. CUTS REJECTS ON MOTOR FRAMES

Auxiliary slides on No. 12 permits machining both ends simultaneously for greater accuracy

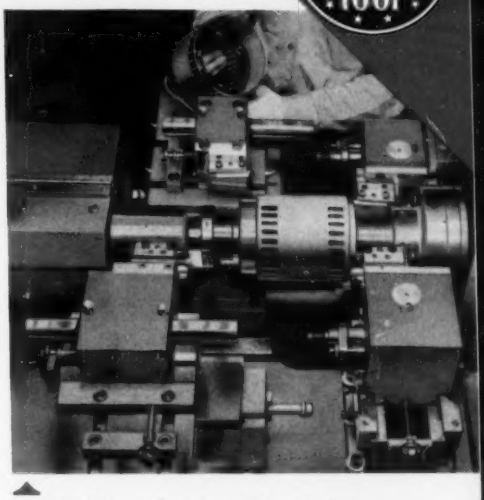
This setup used by A. O. Smith Corporation, Tipp City, Ohio, is worth remembering. It has taken over the work of two older automatic lathes. Smart tooling permits simultaneous machining of rabbet fits at both ends of electric motor frame stator and core assemblies—with the coils in place.

The machine: a versatile Gisholt MASTERLINE No. 12 Automatic Chucking Lathe. Special tooling: tailstock with supporting arbor; shields to keep chips out of the windings; expanding mandrel and bushings to support the work; front and rear auxiliary slides.

Here's how a typical assembly (6½" long, 6" diameter, 3½" bore) is handled: First, chip shields are inserted at both ends. The assembly is placed on the supporting arbor and the tailstock is used to press one shield against a retractable locator at the spindle end of the arbor. An expanding mandrel chucks in the I.D. Tools on the rear independent slide rough-bore the rabbet fit, rough-face and chamfer the I.D. at the tailstock end. Forward feed of this slide actuates the rear auxiliary slide to rough corresponding surfaces at the headstock end. In the same manner, tools on the front carriage and front auxiliary slide finish-bore the rabbet fits and chamfer the O.D. F.t.f. time, a fast 1.0 minute.

Over seven different sizes are handled. The most extensive changeover requires less than one hour.

Machining both ends simultaneously speeds production, eliminates extra handling, improves accuracy. Out-of-round held within .005" total indicator reading, runout within .004" to .006" on parts up to 10" length, up to 6¼" bore.



Overhead view of tooling and work. Note pusher bars on rear independent slide and front carriage, used to operate auxiliary slides and permit simultaneous machining at both ends.

5L CUTS COSTS ON 900-LB. CHUCK BODY FORGINGS

Remote controls, compound cross slide and power chucking save time

If you're machining parts like this 900-lb., SAE 1035 steel 24" chuck body forging, you know it takes power, rigidity and versatility to handle the job at lowest cost.

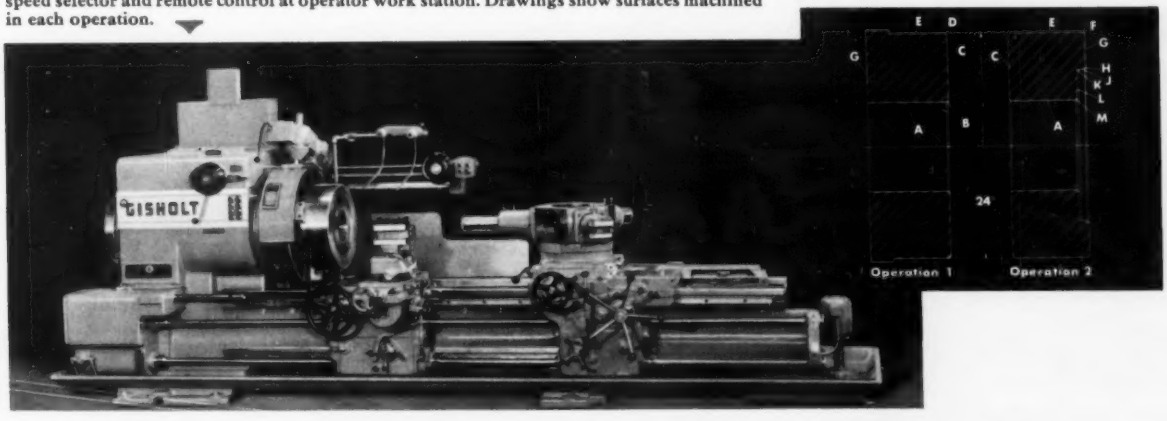
Here's how features and accessories of the Gisholt MASTERLINE 5L Saddle Type Turret Lathe make light work of this heavy job. A compound cross slide with power angular feed simplifies taper boring. A cross-feeding hex turret permits use of standard, low-cost tools for cross-facing, boring various diameters, etc. A second speed selector and remote control save steps and allow the operator to observe the work at all times while changing spindle speeds, starting, stopping, reversing and inching the spindle. Fine finish is assured through a 24-speed headstock, offering a wide choice of speeds in a range from 6 to 340 r.p.m. with maximum metal removal obtained by a 75 h.p. motor. A power hoist supports the work for chucking in a 32", 3-jaw scroll chuck.

Here's the first operation: hex turret tools bore A and face C, while square turret tools turn E and chamfer B-D. Total f.t.f. time, 30.6 minutes. This includes 4.5 minutes used to chuck, operate and unload.

For the second operation, changeover is fast and requires only minor tool replacements, stop adjustments and new chuck jaw inserts. Work is held on the previously machined O.D. Hex turret tools face G-L and bore A-K. Compound square turret tools finish-turn E, taper the co-bore J and chamfer F-H-M. Time f.t.f, 43.4 minutes, including 11.2 minutes to chuck, operate and unload.

Power, rigidity of 31,000-lb. 5L, and proper accessories cut costs, simplify and speed machining of heavy-duty work. Second speed selector and remote spindle control save steps, permit full attention to work.

Simple setup on 5L completes 900-lb., 24" chuck body forging in two operations. Note second speed selector and remote control at operator work station. Drawings show surfaces machined in each operation.



MASTERLINE
GISHOLT SINCE 1887

HOW LONG MFG. DIVISION CUTS TIME 30% ON CLUTCH PRESSURE PLATES

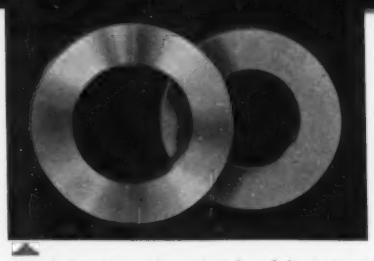
Versatile Simplimatic replaces two lathes and one grinder

Here is a prime example of how you can cut costs, improve accuracy and quality, by combining operations on modern production equipment.

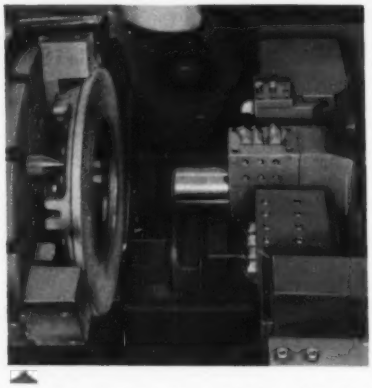
Formerly Long Manufacturing Division, Borg-Warner Corporation, Detroit, Michigan, used two semi-automatic lathes and one grinder to handle four sizes of cast iron clutch pressure plates, supplied to truck manufacturers. Now these parts are completed in one chucking on a Gisholt Simplimatic Automatic Chucking Lathe. The part shown, 16¾″ in diameter, 2⅜″ wide, is held in a 21″, 3-jaw, air-operated chuck. Three independent tool slides are used. The wide platen table simplifies slide location, eliminates "cutting air" and provides ample support with minimum tool overhang during machining.

During the automatic cycle the platen table feeds forward, plunging four facing tools, on the front slide, to depth. Then standard slide movement feeds the four facing tools out from center, roughing the 3¾″-wide face in one-fourth the time that would be required if a single cutter were used. At the same time the center slide feeds forward with piloted tools that rough- and finish-bore and chamfer the I.D. The rear slide operates separately and carries a single tool used to finish-face the part, feeding from the O.D. to the I.D. F.t.f. time, just 3.02 minutes.

Simple setup replaces two semi-automatic lathes and one grinder, cuts handling and machining time over 30%. Rigid tooling on platen table improves accuracy, provides desired surface finish and flatness formerly obtained by grinding.



Clutch pressure plate (produced in lots of 1000) before and after machining. Rigid tooling provides flatness and 120-160 micro-inch RMS finish on the clutch face, formerly obtained by grinding.



Clutch pressure plate casting, showing method of chucking, locating and tooling used to complete part in one automatic cycle.

JETRACER CUTS TIME 25% FOR RIVETT LATHE & GRINDER, INC.

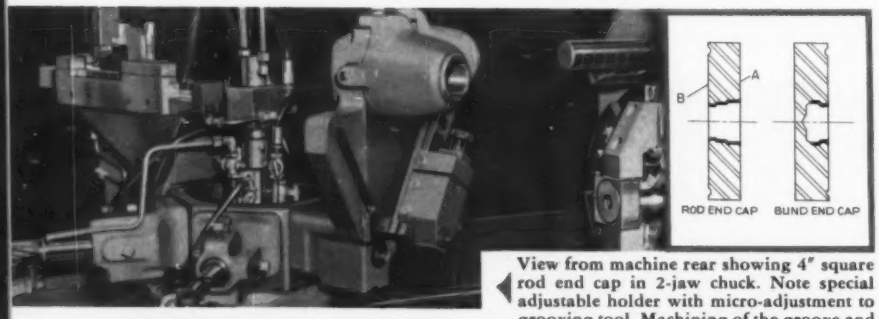
Turret-mounted JETracer slide tool on Fastermatic simplifies job, improves quality

Want to improve accuracy and finish, and speed machining on those tough multi-diameter jobs? Here's a fresh approach used by Rivett Lathe and Grinder, Inc., at its Emery Road plant, Allston, Massachusetts. Setup includes a JETracer slide tool mounted on the turret of a Gisholt 1F MASTERLINE Fastermatic Automatic Chucking Turret Lathe.

The workpieces are end covers for tie rod air cylinders. They are made from steel blanks ranging in size from 2″ square x 1½″ thick to 12¾″ x 2¼″ thick. Ten sizes of each are handled in lots ranging from 200 to 500 pieces. Due to the increased flexibility offered by the JETracer slide tool, all work is handled from the hexagon turret. Eliminating the need for front and rear cross-slide carriage saves additional cost.

All parts are held in an 18″, 2-jaw air-operated chuck. The typical rod end cap shown, 4″ square x 1¾″ thick, is completely machined in just 3.15 minutes f.t.f. time. Work is drilled through and a multi-diameter cutter rough-forms the bore from side A. The cycle stops and the part is reversed. The JETracer generates all bore surfaces shown in black, from side B. The bushing fit diameter is reamed and special holders with micro-tool adjustment rough- and finish-groove the face. The same size blind end cap is machined in a similar manner in 2.45 minutes f.t.f. The surfaces shown in black are traced.

Bore diameters held within .0006″ and 65 micro-inch RMS finish requirement easily met with JETracer, and rigid Fastermatic tooling. Tracing cuts time 25%, keeps tooling costs at a minimum.



View from machine rear showing 4″ square rod end cap in 2-jaw chuck. Note special adjustable holder with micro-adjustment to grooving tool. Machining of the groove and various bore diameters in one chucking assures concentricity and squareness.

The Gisholt Round Table represents the collective experience of specialists in the machining, surface-finishing and balancing of round and partly round parts. Your problems are welcomed here.

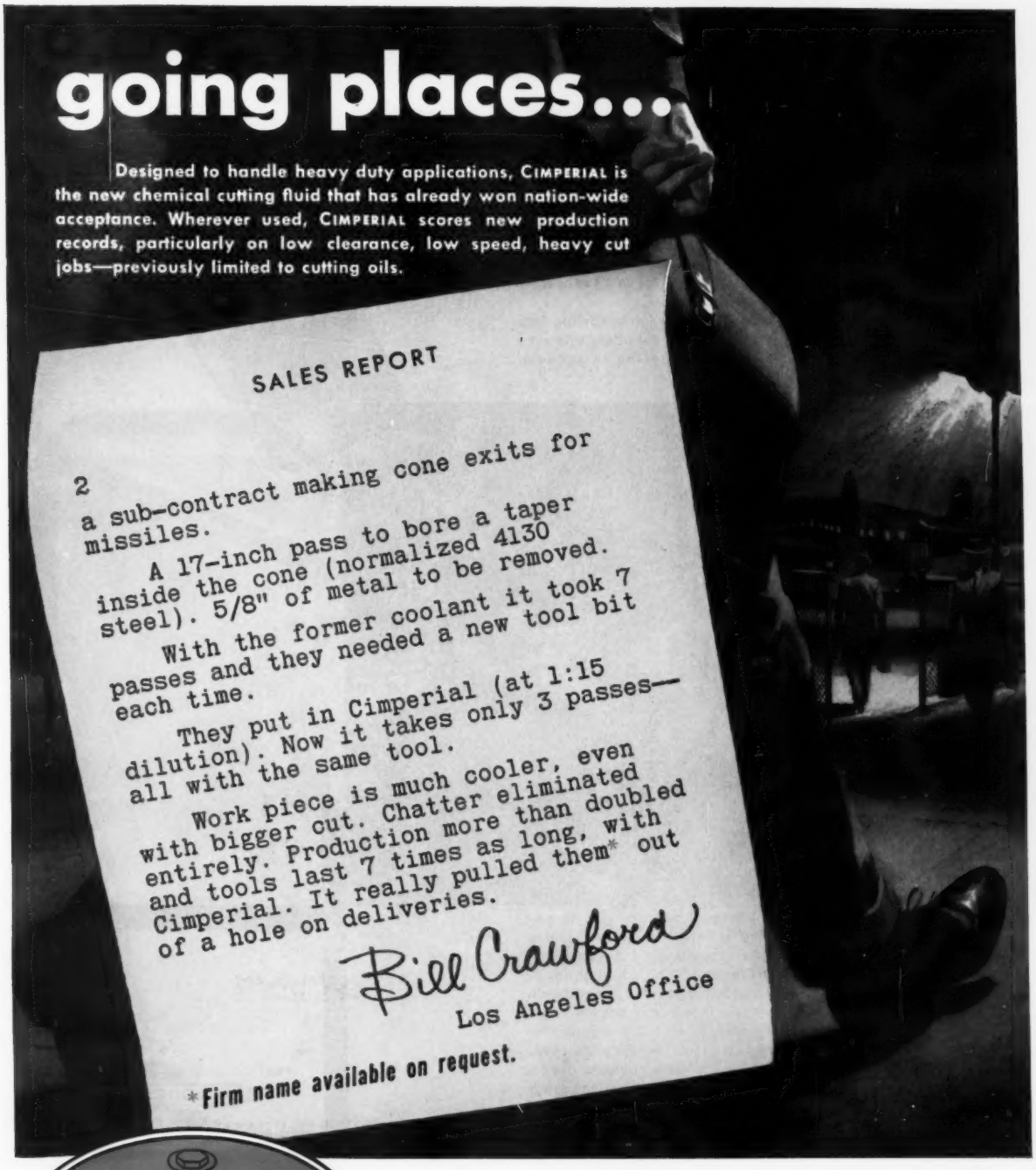
Printed in U.S.A.

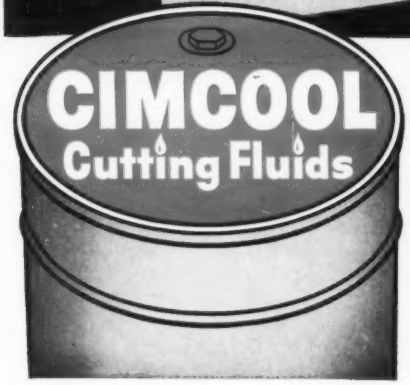
GISHOLT MACHINE COMPANY Madison 10, Wisconsin

Turret Lathes • Automatic Lathes • Balancers • Superfinishers • Threading Machines • Packaging Machines • Masterglas Molded Plastic Products

going places...

Designed to handle heavy duty applications, CIMPERIAL is the new chemical cutting fluid that has already won nation-wide acceptance. Wherever used, CIMPERIAL scores new production records, particularly on low clearance, low speed, heavy cut jobs—previously limited to cutting oils.


SALES REPORT
2
a sub-contract making cone exits for missiles.
A 17-inch pass to bore a taper inside the cone (normalized 4130 steel). 5/8" of metal to be removed.
With the former coolant it took 7 passes and they needed a new tool bit each time.
They put in Cimperial (at 1:15 dilution). Now it takes only 3 passes—all with the same tool.
Work piece is much cooler, even with bigger cut. Chatter eliminated entirely. Production more than doubled and tools last 7 times as long, with Cimperial. It really pulled them* out of a hole on deliveries.
Bill Crawford
Los Angeles Office
*Firm name available on request.



FOR 100% OF ALL METAL CUTTING JOBS

Production-proved products of The Cincinnati Milling Machine Co.

CIMPERIAL—newest in the famous, industry-proven line of CIMCOOL® Cutting Fluids!
CIMCOOL S2 Concentrate—The pink fluid which covers 85% of all metal cutting jobs.
CIMPLUS—The transparent grinding fluid which provides exceptional rust control.
CIMCUT Concentrates (AA, NC, SS)—For every job requiring an oil-base cutting fluid.
ALSO—CIMCOOL Tapping Compound—CIMCOOL Bactericide—CIMCOOL Machine Cleaner.

For full information on the complete family of CIMCOOL Cutting Fluids, call your CIMCOOL Distributor. Or contact Cincinnati Milling Products Division, Cincinnati 9, Ohio.

®Trade Mark Reg. U.S. Pat. Off.

For more data, circle this page number on inquiry card

The hot peeling machine introduces a new principle in the ingot conditioning making possible these important advantages:

1) Elimination of the cooling process after stripping with the consequent elimination of cracking dangers.
2) Complete use of the stripping heat which is lost by conventional systems. This will result in the elimination of annealing treatment cost and of scrap dangers.
3) Substantial reduction in working time.
4) Simplification of the whole operating cycle due to saving in material handling.

hot ingot

5) Possibilities of performing a further peeling on the ingot face should a deeper conditioning be required.
6) Improvement of the rolled products when obtained from hot peeled ingots.
7) Complete recovery of peeling chips.
8) Drastic reduction of costs and considerable improvement of the production.

The conditioning cycle is automatic; a 6 t. ingot can be completely machined in 5 minutes without operator's assistance. A daily production of 1000 t. can be obtained.

The machine cost can be amortized in only one year considering the savings and the higher production.

Operation and maintenance are very simple. The hydraulic controls and the automatic operation of the equipment make possible a perfect performance.

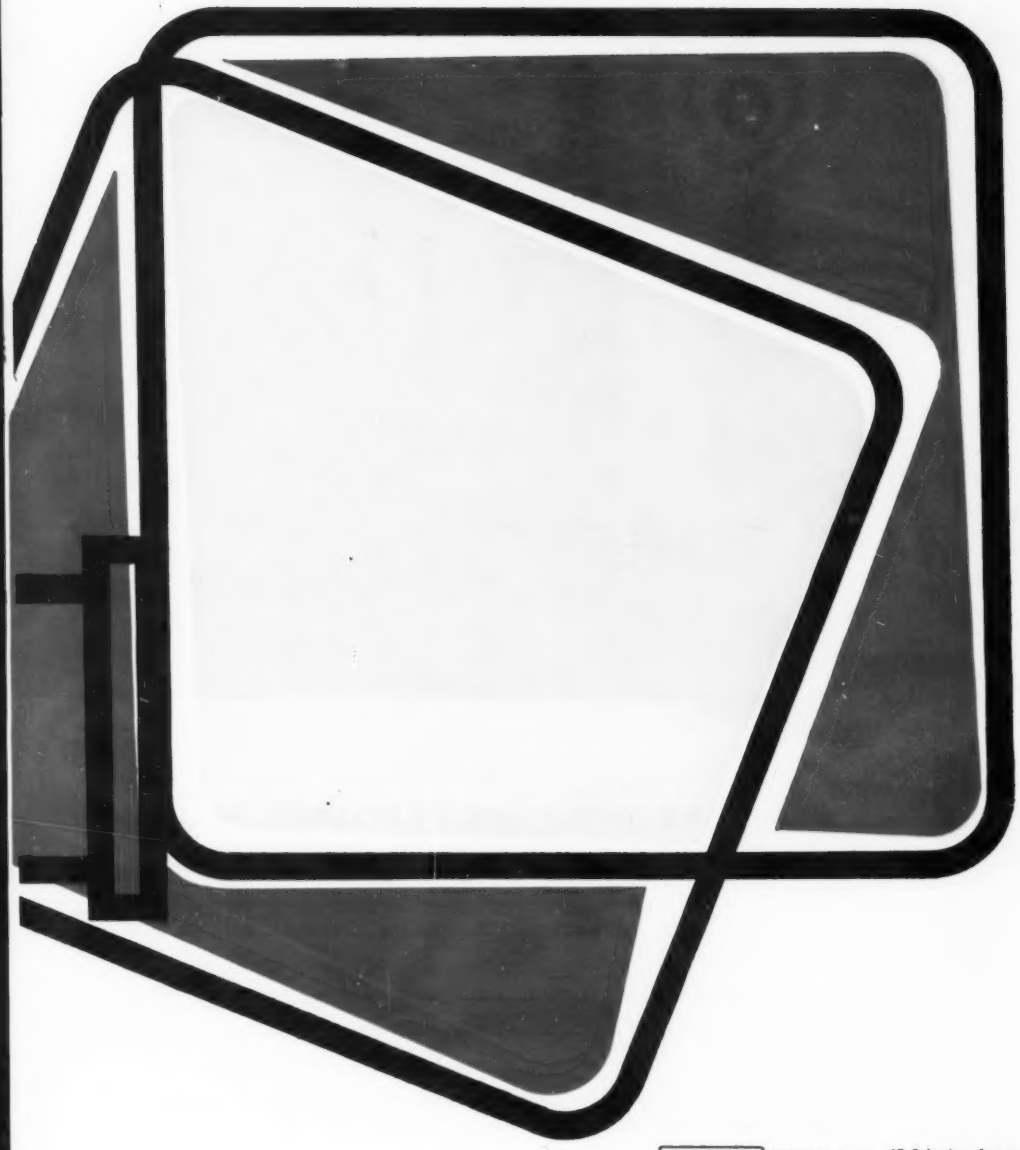
INNOCENTI

bertani a3 58

peeling machine

INNOCENTI

società generale per l'industria metallurgica e meccanica



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INNOCENTI CORPORATION . 45 Columbus Avenue
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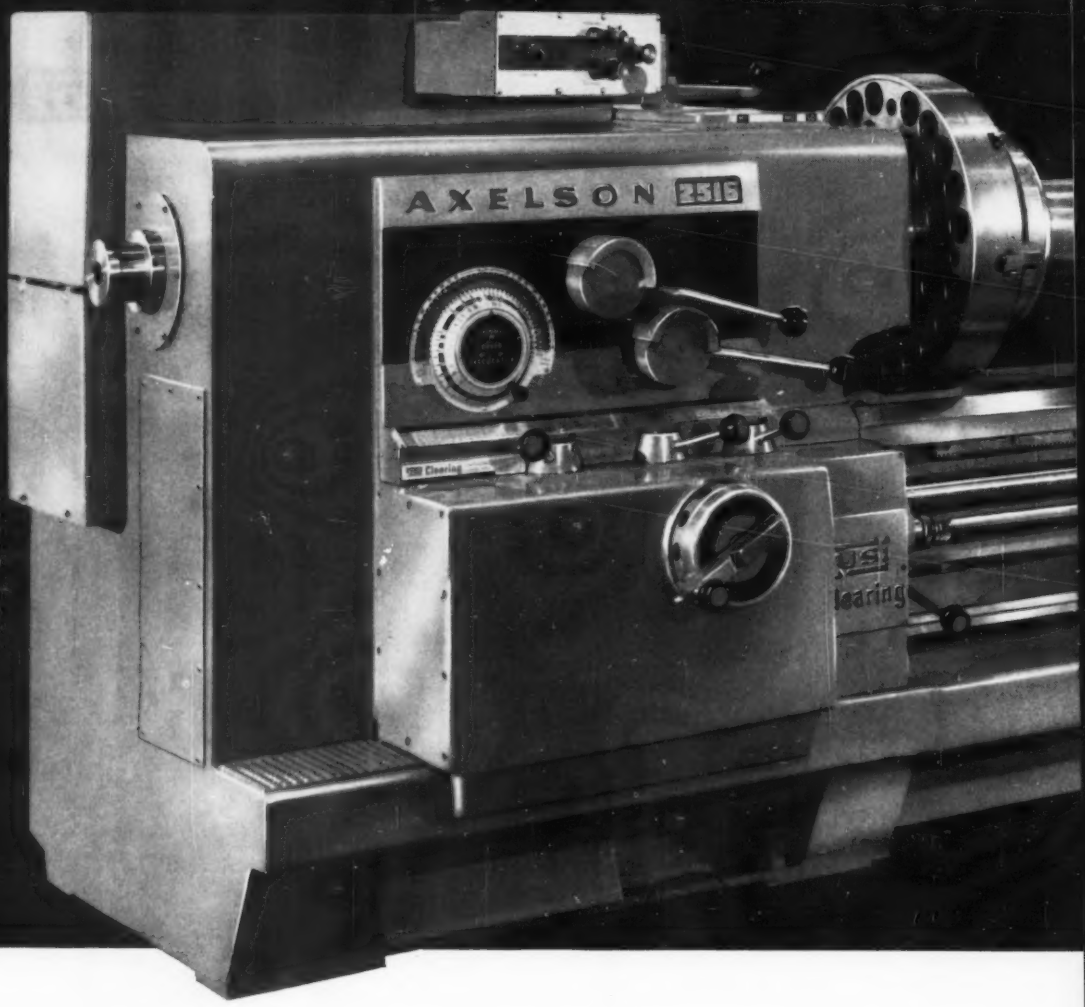
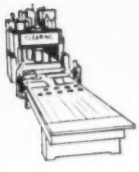
HERE'S the World's finest Lathe Value—it costs no more

THE NEW WELDED STEEL CLEARING-AXELSON



The unusually high powered Blue Chip lathe is designed and built heavier to breeze through the toughest work where ceramic or carbide tooling is used. You'll be amazed at the lack of vibration—the smooth, effortless operation of the Blue Chip lathe.



Clearing, division of U.S. Industries, Inc. also manufactures power presses of all types, dies and special tooling, and special equipment for the aircraft and missiles industry.

HERE ARE THE PLUS FEATURES YOU'LL

- **Built especially for carbide and ceramic tooling—Heavier and faster cutting**
- **No vibration even on toughest jobs—Means precision finishes and longer tool life**
- **All steel welded construction—18 times more rigid than any other lathe**
- **"Building Block" Bed and headstock construction—Prevents obsolescence**
- **"Unitized" Design of drive, gearing, controls, electrical equipment—Easier routine maintenance**

USI Clearing

DIVISION OF U. S. INDUSTRIES, INC.

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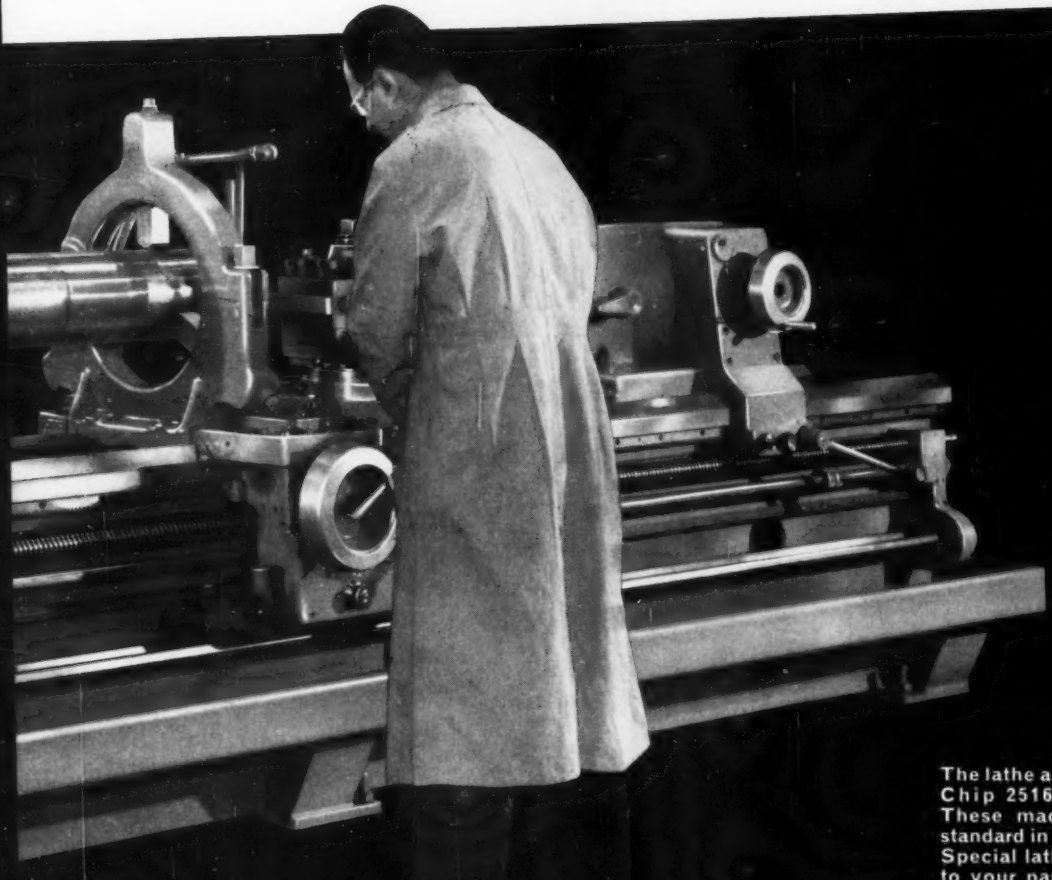
BLUE CHIP LATHE

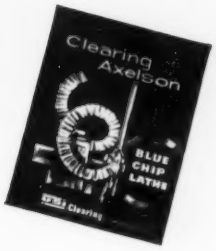


The lathe above is the Blue Chip 2516 or 20" lathe. These machines are also standard in 16" and 25" sizes. Special lathes will be built to your particular requirements.

FIND ON THE BLUE CHIP LATHE

- Bed and headstock "Built-to-the-Floor"—For extra rigidity
- Forty spindle speed selections—More than any other lathe, Offers precise cutting control
- Eighty-eight feeds and threads—To suit any need
- Higher speeds—Up to 2,000 R.P.M.
- Faster setups
- Economical power shift options
- Direct reading digital tail stock dial—Saves time in drilling and boring
- Horsepower meter—insures efficient cutting at all times

4-Way rapid traverse available

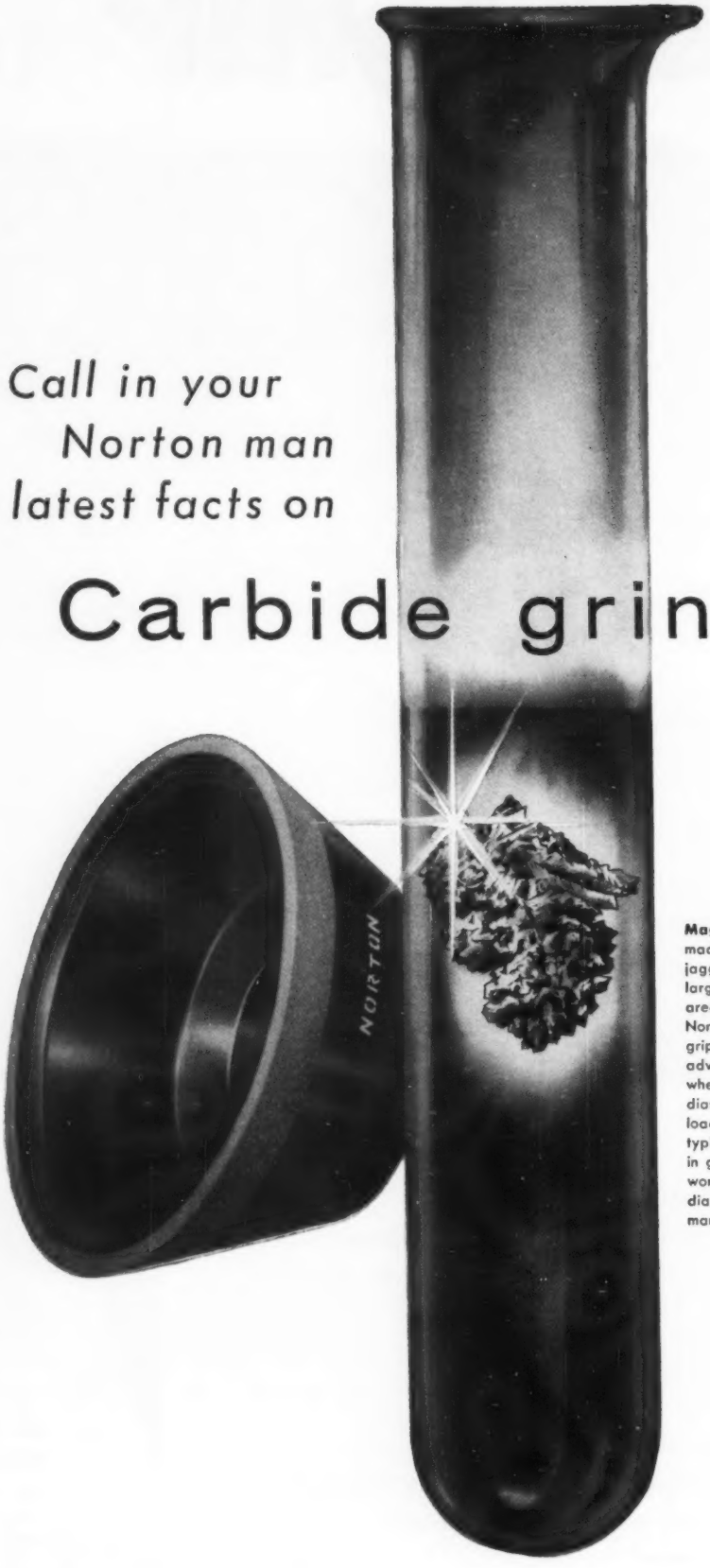


GET THE FULL STORY

It's told in this new catalog on the Blue Chip Lathe. Your free copy is ready now.

Call in your Norton man for the latest facts on

Carbide grinding



Magnified View of a man-made diamond. The extremely jagged surface provides a large, tight-holding contact area for bonding. In the new Norton SD wheels this extra gripping power, teamed with advancements in diamond wheel construction, reduces diamond loss and carbide loading to a minimum — typical of Norton leadership in getting the maximum working power out of all diamonds, mined or man-made.

with Norton wheels

using mined or man-made diamonds

Norton diamond wheels — the most complete line for carbide grinding — are backed by pioneering never equalled, whether the diamonds used are mined or man-made.

Norton began its leadership in diamond wheel development back in 1930 . . . introduced all three bond types (resinoid, metal and vitrified) of diamond wheels ...does all its own sizing and checking of diamonds... duplicates wheel specifications with constant accuracy.

Today Norton leadership continues with the use of man-made diamonds. Among the newest, most efficient materials produced for industry, man-made diamonds last longer in grinding wheels for many carbide grinding operations because they are more firmly anchored in the bond . . . and because their greater friability presents new cutting edges faster, thereby decreasing power requirements and speeding cutting action.

These properties of man-made diamonds are used to their fullest advantages in the new Norton SD resinoid and vitrified wheels. This has been proved in more than a year of nation-wide, comparative testing . . . *In 63% of hundreds of field tests the average service life of Norton SD diamond wheels was at least 25% longer than the life of wheels using natural, mined diamonds, with no loss in cutting action.*

With each Norton diamond wheel, of mined or man-made diamonds, you get a certificate of the accuracy of diamond concentration. You can depend on this certificate to mean exactly what it says and what you're paying for.

You can depend on your Norton Man, too. This expert Abrasive Engineer has kept close contact with the development of man-made diamonds for grinding applications since the start. He can help you take a giant step forward in your carbide grinding — can show you how to get better grinding quality, longer service life and lower cost grinding for every dollar you spend on diamond wheels. NORTON COMPANY, General Offices, Worcester 6, Mass. Plants and distributors around the world.

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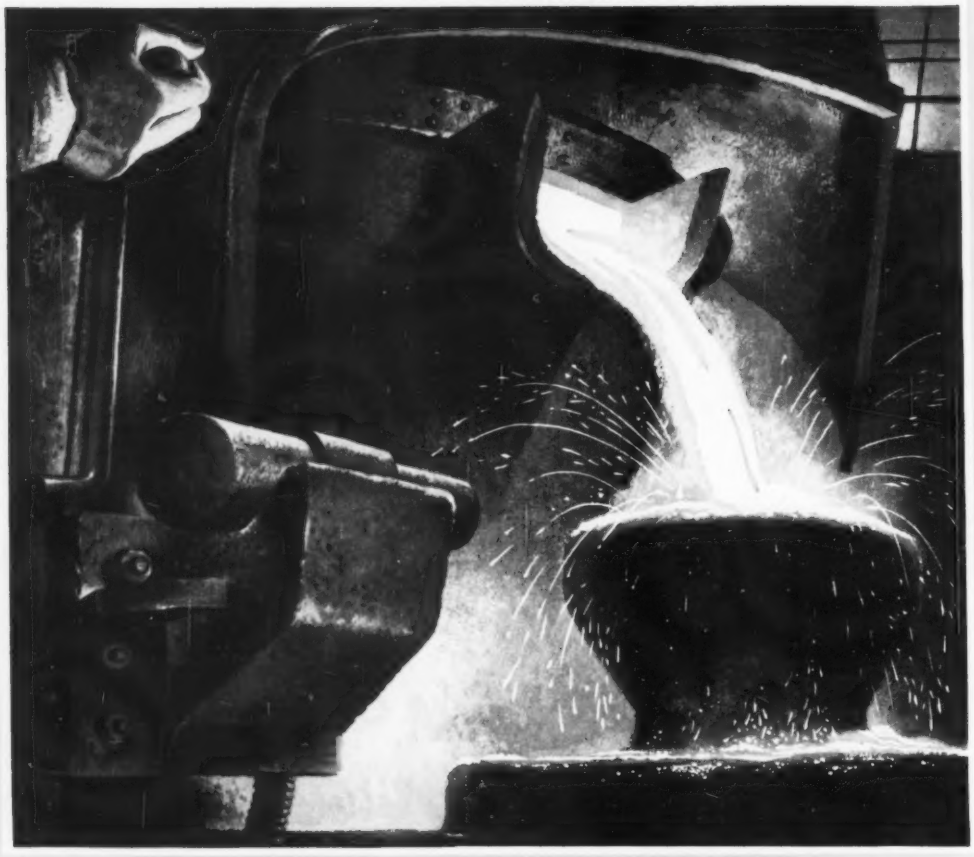


Melting furnace at Calumet & Hecla, Inc.—Wolverine Division, where Shell Irus Fluid 902 eliminates the danger of hydraulic line fires.

Ready... aim... NO FIRE!

Take 10 high-temperature alloy-melting furnaces, hydraulically operated—each pouring 1500 lbs. of molten metal every hour in close proximity to "live" hydraulic lines—and you can readily see why selection of hydraulic fluids is important to Calumet & Hecla's Wolverine Tube Division.

Now the operation is made more reliable by the use of Shell Irus Fluid 902, a water-in-oil emulsion type fluid. Irus® Fluid was C & H's choice, after carefully studying other commercial hydraulic fluids—for many reasons:

1. Irus Fluid will not support combustion.
2. Irus Fluid has excellent lubricating properties.
3. Irus Fluid has hydraulic efficiency and equipment compatibility.
4. Irus Fluid is economical, costing about one-third less than other fire-resistant fluids.
5. Irus Fluid's bright yellow color makes it easy to spot and trace leaks.

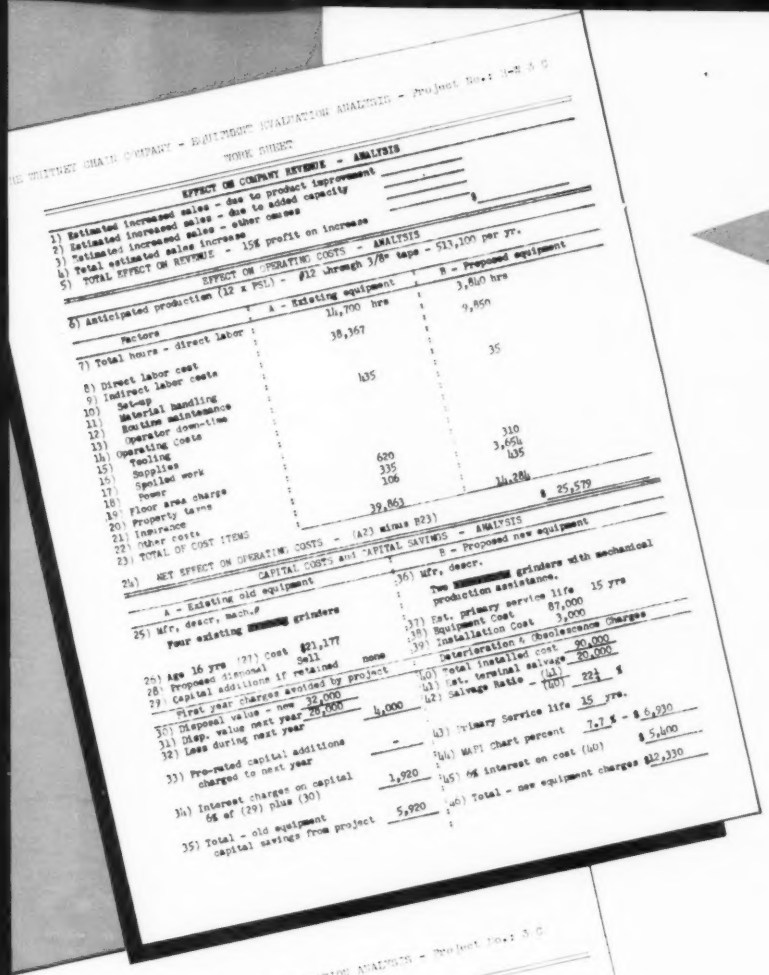
In plant after plant, operators find that these advantages assure maximum safety to both personnel and equipment.

If you have a hydraulic line fire hazard, we suggest that you have the Shell Industrial Products Representative show you the many advantages in Irus Fluid 902; or write to Shell Oil Company, 50 W. 50th St., New York 20, N. Y., or 100 Bush St., San Francisco 6, Calif. In Canada: Shell Oil Company of Canada, Ltd., 505 University Ave., Toronto 2, Ontario.

SHELL IRUS FLUID 902

the low-cost, fire-resistant hydraulic fluid

SHELL



EFFECT ON COMPANY REVENUE - ANALYSIS

1) Estimated increased sales - due to product improvement
2) Estimated increased sales - due to added capacity
3) Estimated increased sales - other causes
4) Total estimated sales increase
5) TOTAL EFFECT ON REVENUE - 15% profit on increase — $

EFFECT ON OPERATING COSTS - ANALYSIS

Factors	A - Existing equipment	B - Proposed equipment
6) Anticipated production (12 x PSL) - #12 through 3/8" taps - $13,100 per yr.	11,700 hrs	3,840 hrs
7) Total hours - direct labor	38,367	9,850
8) Direct labor cost		
9) Indirect labor costs	435	35
10) Setup		
11) Material handling		
12) Routine maintenance		
13) Operator downtime		310
14) Operating Costs		3,664
15) Tooling	620	435
16) Supplies	335	
17) Spoiled work	106	
18) Power		14,284
19) Floor area charge	39,863	
20) Property taxes		$ 25,579
21) Insurance		
22) Other costs		
23) TOTAL OF COST ITEMS	(A2) minus B23)	
24) NET EFFECT ON OPERATING COSTS - ANALYSIS		

CAPITAL COSTS and CAPITAL SAVINGS - ANALYSIS

A - Existing old equipment

25) Mfr, descr, mach.#
Four existing [redacted] grinders

26) Age 16 yrs (27) Cost $21,177
28) Proposed disposal Sell none
29) Capital additions if retained

First year charges avoided by project
30) Disposal value - new 32,000
Disposal value next year 28,000 4,000
31) Disp. value next year
32) Less during next year —

33) Pro-rated capital additions charged to next year 1,920

34) Interest charges on capital 6% of (29) plus (30) 5,920

35) Total - old equipment capital savings from project

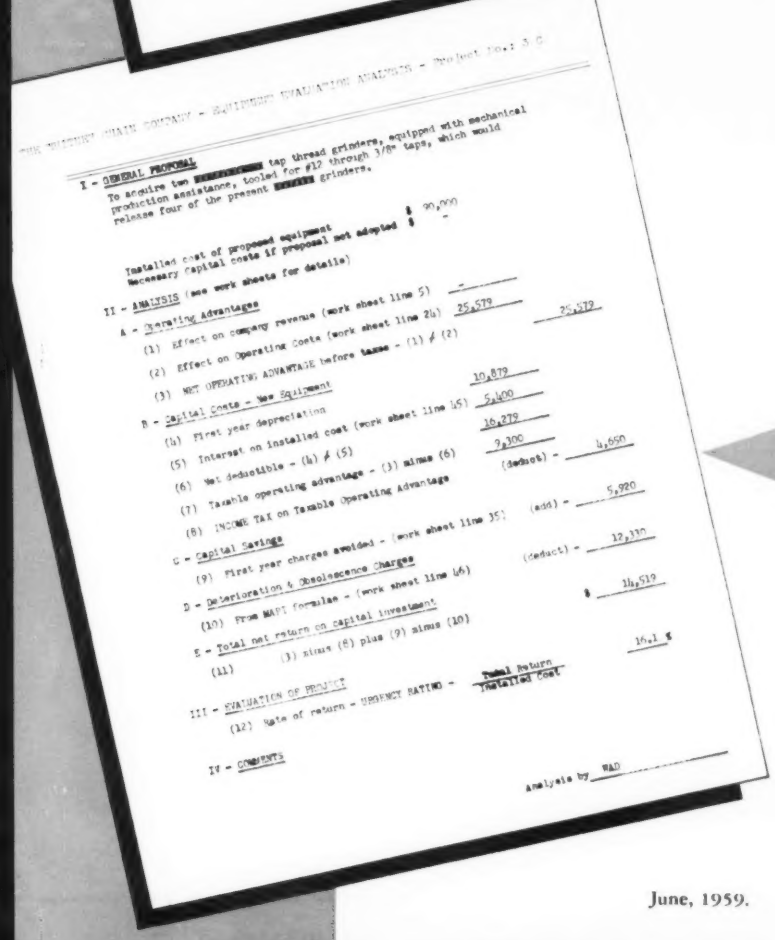
B - Proposed new equipment

36) Mfr, descr.
Two [redacted] grinders with mechanical production assistance.

37) Est. primary service life 15 yrs
38) Equipment Cost 87,000
39) Installation Cost 3,000

Deterioration & Obsolescence Charges
40) Total installed cost 90,000
41) Est. terminal salvage 20,000
42) Salvage Ratio - (41) / (40) 22¼ %

43) Primary Service life 15 yrs. — 7.7 % - $ 6,930
44) MAPI Chart percent $ 5,400
45) 6% interest on cost (40) $12,330
46) Total - new equipment charges



I - GENERAL PROPOSAL

To acquire two [redacted] tap thread grinders, equipped with mechanical production assistance, tooled for #12 through 3/8" taps, which would release four of the present [redacted] grinders.

Installed cost of proposed equipment $ 90,000
Necessary Capital costs if proposal not adopted $ —

II - ANALYSIS (see work sheets for details)

A - Operating Advantages
(1) Effect on company revenue (work sheet line 5) —
(2) Effect on Operating Costs (work sheet line 24) 25,579
(3) NET OPERATING ADVANTAGE before taxes - (1) + (2) 25,579

B - Capital Costs - New Equipment
(4) First year depreciation 10,879
(5) Interest on installed cost (work sheet line 45) 5,400
(6) Net deductible - (4) + (5) 16,279
(7) Taxable operating advantage - (3) minus (6) 9,300
(8) INCOME TAX on Taxable Operating Advantage (deduct) - 4,650

C - Capital Savings
(9) First year charges avoided - (work sheet line 35) (add) - 5,920

D - Deterioration & Obsolescence Charges
(10) From MAPI formulae - (work sheet line 46) (deduct) - 12,330

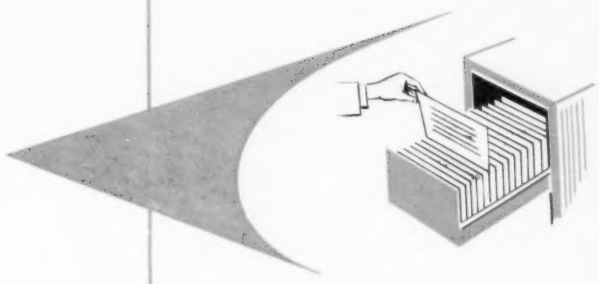
E - Total net return on capital investment
(11) (3) minus (8) plus (9) minus (10) $ 14,519

III - EVALUATION OF PROJECT
(12) Rate of return - URGENCY RATING - Total Return / Installed Cost 16.1 %

IV - COMMENTS

Analysis by WAD

June, 1959.



Presenting Equipment Analysis Forms From the Files of Whitney Chain Company

"It is not enough to replace equipment as the need to do so becomes apparent, or to merely spend the Company's depreciation because good business practice dictates this course. Much greater profit opportunity usually appears when a systematic study of more than one investment opportunity is made."

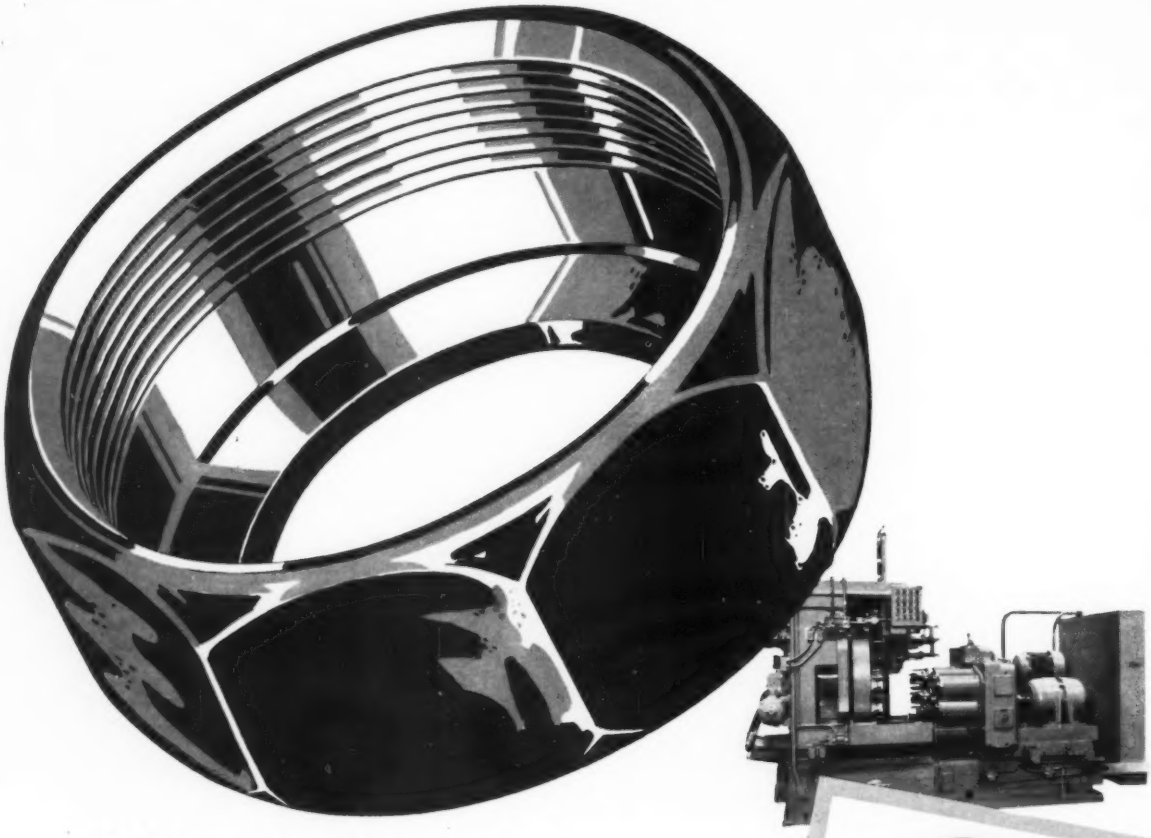
L. H. WHITNEY
President
THE WHITNEY CHAIN COMPANY

Subsidiary of
Foote Bros. Gear and Machine Corporation

Keep Gathering Metal Working Production Ideas . . . Be well Informed When You Replace Machinery

ROCKFORD INSERT GROUP

...an example of Automatic Production by Greenlee...



700 malleable iron pipe fittings an hour...

The Greenlee 5 station, horizontal, automatic indexing machine shown above was designed and built for high-production machining of malleable iron pipe fittings. The pipe fittings are loaded, four at a time, indexed and machined at the rate of 576 to 712 pieces an hour, depending on size. The machine accommodates five different sizes of fittings.

STATION 1 — automatic load
STATION 2 — bore and rough counter-bore
STATION 3 — finish counter-bore and chamfer
STATION 4 — tap
STATION 5 — automatic unload

Let a Greenlee representative show you the modern Greenlee approach to automatic production.

MACHINES DESIGNED . . .
WITH THE FUTURE IN MIND

GREENLEE

TRANSFER MACHINES

GREENLEE STANDARD AND SPECIAL MACHINE TOOLS

- Multiple-Spindle Drilling and Tapping Machines
- Six and Four-Spindle Automatic Bar Machines
- Hydro-Borer Precision Boring Units
- Die Casting Machines
- Trim Presses

GREENLEE BROS. & CO.

1702 MASON AVE.
ROCKFORD, ILLINOIS

CENTER OF MACHINE-TOOL EXCELLENCE **ROCKFORD, ILLINOIS, U.S.A.**

B&T DIE CASTING MACHINE CUSTOMERS ARE OUR BEST SALESMEN

Our customers are practical men. They have years and years of die casting experience with Aluminum, Magnesium and Zinc.

These are the men for whom B & T Die Casting Machines are designed and built.

These are the men who will tell you that the B & T clamp four corner toggle system assures high lock-up to the rated tonnage.

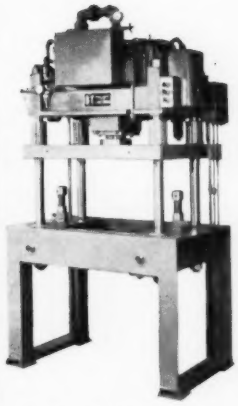
Exceptional rigidity of this four corner lock-up and support provides unusual platen stability.

Our customers will assure you that B & T Die Casting Machines lower maintenance costs, reduce scrap and improve production.

When you need a die casting machine, investigate B&T. B&T Die Casting Machines are built in High-Pressure, Cold-Chamber and Hot-Chamber, Gooseneck types. Capacities are: 125, 200, 300, 400, 500, 600, 750 and 800 tons.

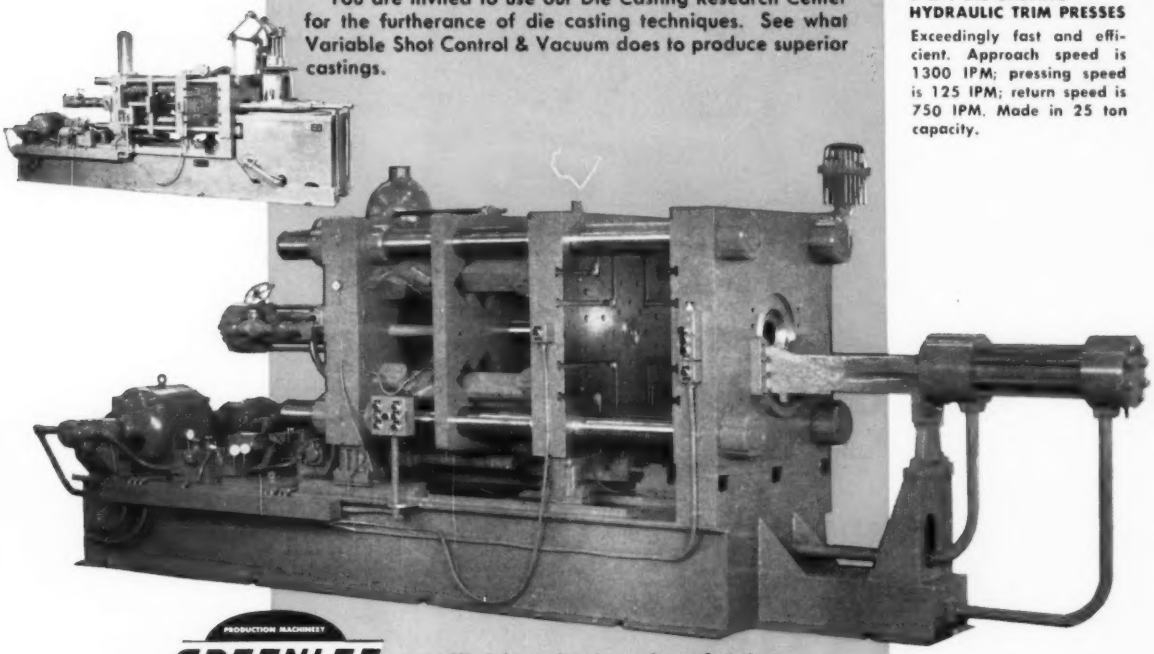
DIE CASTING RESEARCH

You are invited to use our Die Casting Research Center for the furtherance of die casting techniques. See what Variable Shot Control & Vacuum does to produce superior castings.



B & T DIE CASTING HYDRAULIC TRIM PRESSES

Exceedingly fast and efficient. Approach speed is 1300 IPM; pressing speed is 125 IPM; return speed is 750 IPM. Made in 25 ton capacity.



PRODUCTION MACHINERY
GREENLEE

All of the engineering and manufacturing facilities of Greenlee Bros. & Co. are now available to B & T Machinery Company.

B & T MACHINERY COMPANY
A DIVISION OF GREENLEE BROS. & CO., ROCKFORD, ILLINOIS

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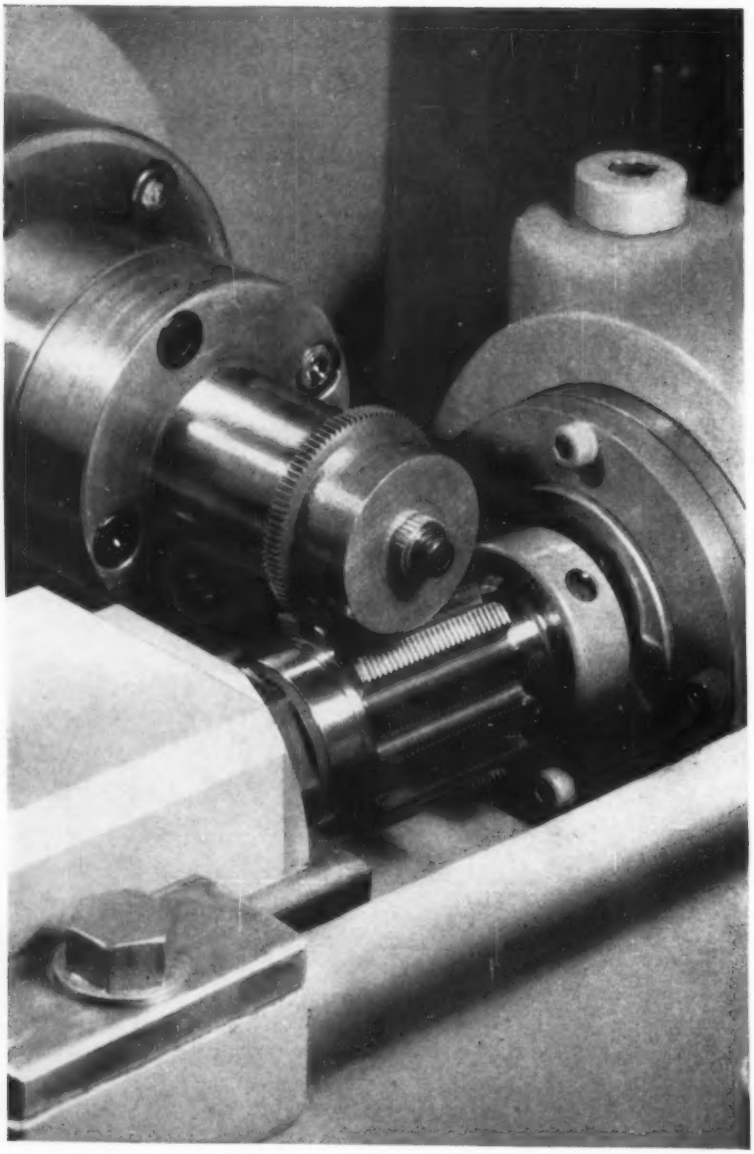
CITY OF MACHINE-TOOL SPECIALISTS **ROCKFORD, ILLINOIS, U.S.A.**

New method of producing

AGMA Precision



Selection and segregation no longer necessary to insure precision-matched spur gear sets

Selection and segregation — the process of producing more gears than you need in order to select a few that are within Precision Class 2 or Class 3 tolerances — is no longer necessary. And, these jobs at PIC Design Corporation, East Rockaway, L.I., New York, prove it.

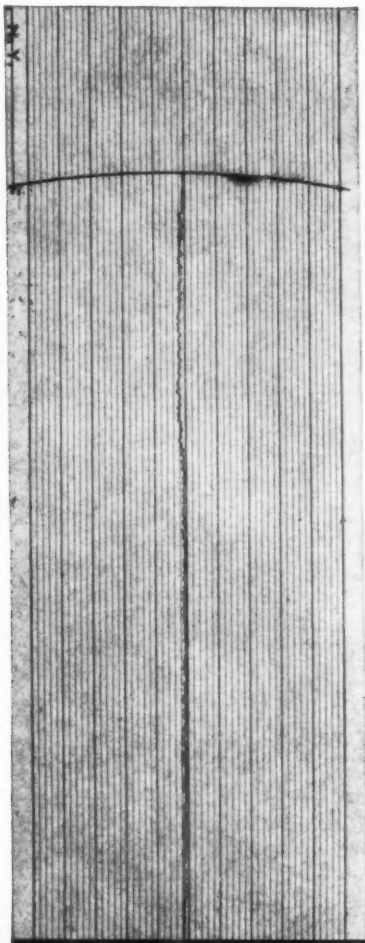
In pioneering "Ultracision" accuracy for the missiles industry, Barber-Colman Company developed extensive machining and testing techniques now embodied in a new, low-cost hobbing machine — the No. 2½-4. For mass production of easily machinable parts which do not require such a high degree of accuracy, a high-speed version of this machine is available with a maximum hob speed of 2400 rpm.

Completely new hobbing machine

New concepts have been introduced into the Barber-Colman No. 2½-4 to bring you exceptional accuracy at a nominal cost. The No. 2½-4 is guaranteed to index accurately within 20 seconds of arc. This means that nonadjacent spacing error on a 2″ dia. gear would be only .0001″ due solely to the indexing error of the machine. When rigid tooling . . . accurate blanks . . . care in mounting the hob and work . . . Class AA hobs . . . and accurate hob-sharpening methods are used, it should be possible to hob AGMA Precision Class 2 and Class 3 gears without selection and segregation. Scrap and inspection time are reduced. And, in many

CENTER OF MACHINE-TOOL EXCELLENCE **ROCKFORD, ILLINOIS, U.S.A.**

Class 3 Gears



Each line on tape represents .0001". This Precision Class 3 gear was obtained with only slightly more care than required for Class 2 gears.

cases, deeper savings can result from the elimination of finishing operations.

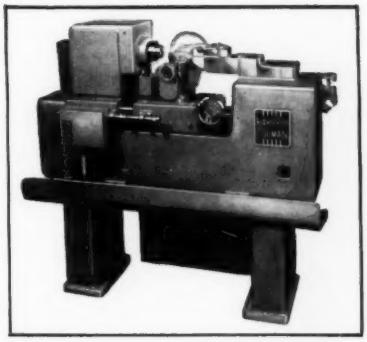
The accompanying PIC "true blue" gear tape shows the inspection record of a Precision Class 3 gear. On the production run, all gears had a total composite error of less than .0004". The gears have 96 teeth of 64 DP. The tape is made on a variable center-distance checking machine with a motor-driven master gear which rolls under preset pressure with the cut gear. After the work spindle adapter and the hob were trued within .0001", no further adjustments were necessary for hobbing gears of this accuracy.

The No. 2½-4 accommodates 3" dia. hobs, permitting maximum number of flutes for cutting accurate, smooth tooth profiles. Maximum work diameter is 2½" and length of cut is 2¼" — for steel gears as coarse as 30 pitch or brass up to 20 pitch.

PIC pursues accuracy in every corner of production

As you examine the results being achieved with the No. 2½-4 by PIC Design Corporation, you will see that in their pursuit of predictability and precision, no stone is left unturned.

Bores of Precision Class 2 and 3 gear blanks are machined to +.0002", -.0000" for size and roundness. Before turning, blanks are mounted on arbors the same size as the bores, with a .0002" taper. They are inspected for face wobble and must run true within .0002" per inch of diameter before the OD's are turned to a concentricity tolerance of .0001". This operation is checked at two points, 180 deg. apart.



In hobbing, the arbors are held in a floating adapter which permits fine adjustment to desired concentricity. PIC uses only Barber-Colman Class A or AA hobs, trued on the machine to less than .0001" runout.

Evaluate your gear processing and costs

If you have the problem of producing precision fine-pitch gears at a profit or want to improve your product by increasing gear accuracy, a Barber-Colman process analyst will help you evaluate methods, tooling, and cost improvements. Phone your B-C representative or the factory — WO 8-6833.

Barber-Colman Company

BARBER COLMAN ®

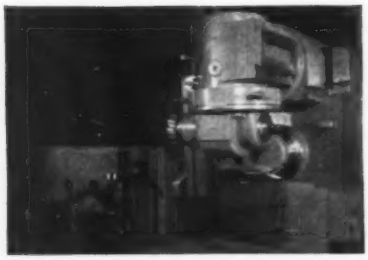
62 Loomis Street, Rockford, Illinois

FOR PRODUCTION MACHINE TOOLS IT'S **ROCKFORD, ILLINOIS, U.S.A.**

SUNDSTRAND

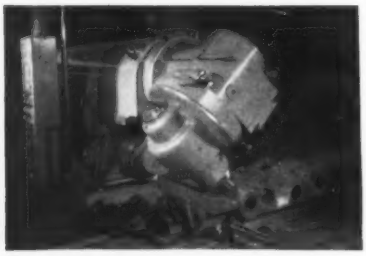
"ENGINEERED PRODUCTION" NEWS

Universal Bed Type Rigidmil Combines Flexibility with High HP in Cutting Costs on Large Work

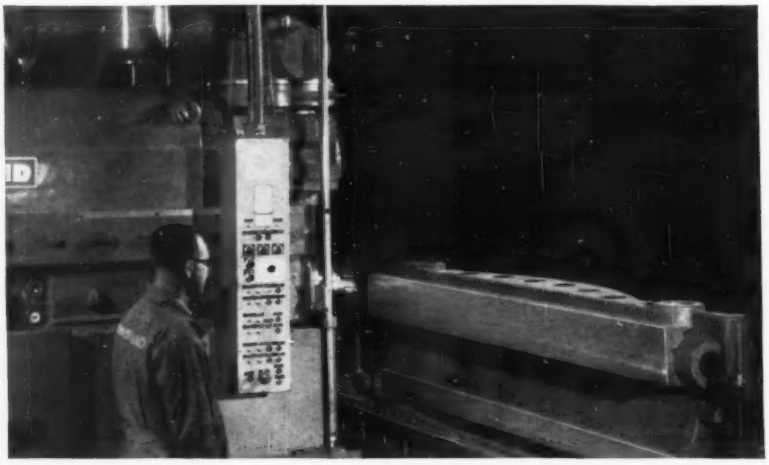


Machining end of work piece is illustrated in this example using all angle head in horizontal position and vertical feed.

Machining on top of the work is illustrated in this example using the All Angle head and longitudinal table feed.



All angle head is used to mill clearance cuts at an angle using transverse feed. All power feeds are infinitely variable.



Horizontal spindle and longitudinal table feed are used for face milling first surfaces of large casting.

Because this universal bed-type Rigidmil milling machine was able to machine a total of 28 surfaces on this large, heavy casting in just two setups, sizable savings were effected through a reduction in handling and setup times. Production is not sacrificed to gain flexibility as both the horizontal spindle and the all angle head have the horsepower needed for heavy cuts using carbide cutters, 50 and 20 hp respectively.

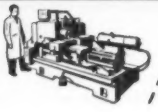
Positioning the cutter instead of the work, eliminates special fixtures needed to machine complex angles on conventional machines, and reduces set-up time. Accuracy standards invariably exceed those possible on other machines because of the reduction in workpiece handling.

Machine has a table feed stroke up to 216 inches, transverse feed stroke of 24″ and vertical feed stroke of 26″ making possible machining on large work pieces. Pushbutton pendant control of all machine speeds and movements enables the operator to keep close control over every type of job.

In addition, slab milling can be performed with the main spindle by mounting an arbor support on the dovetail ways provided. An extra cost option is a power operated draw rod for the horizontal spindle that simplifies cutter change.

AUTOMATIC LATHES | MILLING MACHINES | SPECIAL MACHINES | DRILLING MACHINES | GRINDERS

SUNDSTRAND



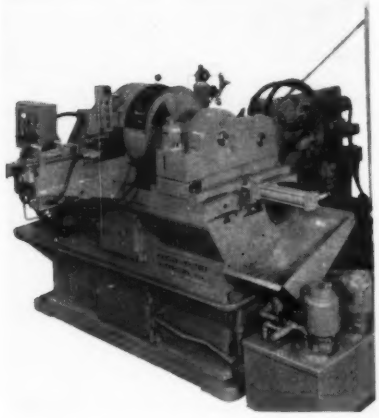
MACHINES DESIGNED TO MEET YOUR NEEDS **ROCKFORD, ILLINOIS, U.S.A.**

Steering Gear Part Thread-Milled in Automatic Setup

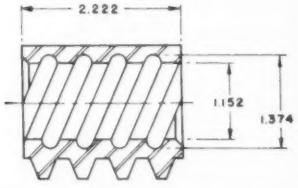
A two pass operation that leaves minimum stock to be removed in a following finish-grinding operation is used to produce approximately 72 ball nut components for automotive steering gears per hour on this Sundstrand Hanson-Whitney thread milling machine. Material is SAE 5120 steel.

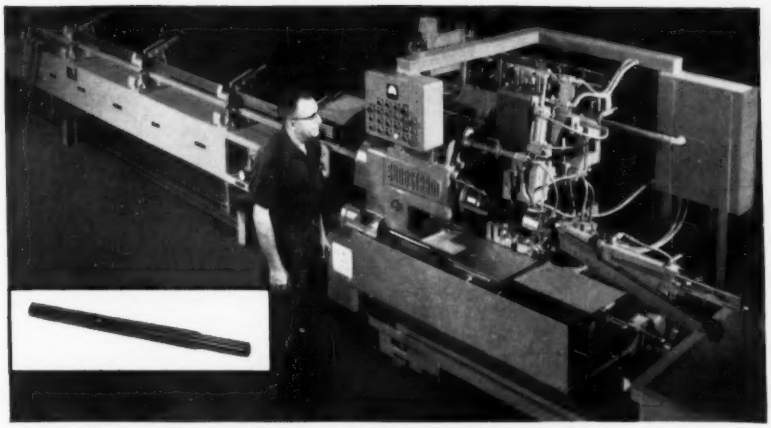
Because of the limiting physical dimensions of the cutter (small diameter in relation to length) a rough cut and finish cut are made to hold stock to a minimum for final grinding operations. Both rough and finish cuts are in one automatic cycle.

The completely automatic cycle, including load and unload, permits the operation to be handled with minimum operator skills and allows one operator to handle several machines.



Hanson-Whitney 10 x 24 inch machine built by Sundstrand equipped for automatic production, including load and unload, of automotive component. Principal dimensions of ball nut unit are shown below.





Hopper-Fed Sundstrand Lathe Turns 450 Shafts Per Hour

A special hopper arrangement for automatic feeding of bar stock to permit continuous cycling helps this Model 6A Sundstrand Lathe set a fast production pace. Fractional horsepower motor shafts are turned at an average rate of 450 per hour with lengths of finished shafts ranging from 9 to 13 inches.

Bar stock is fed automatically thru the spindle; is cut to length, turned, and grooved; and is automatically ejected onto the conveyor at the completion of the machine cycle. Front, rear, and overhead tools are provided to reduce machining time. Because production requirements change frequently, quick setup tooling using micrometer tool blocks and stops is used. Not only does this permit reduced change-over time but it also eliminates the need for trial cuts at the start of a new production run.

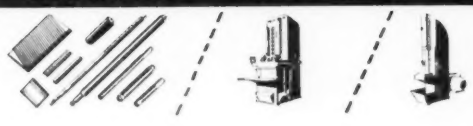
Ceramic Tooling Keeps Brake Drum Output High

Combining ceramic tooling with the modern design features of the Sundstrand vertical lathe has opened the way to new highs in production efficiency on this brake drum turning operation. Hourly production is now at 72 units per hour at 80% efficiency, at nearly double the surface speed used with carbides. Surface finishes exceed any previously attained, eliminating the need for a sanding operation formerly required.

Easy loading and unloading made possible by the vertical lathe design play an important role in the increased production rate. Open front vertical machine makes it easy to provide automatic chip disposal, an important advantage in view of the high rate of metal removal.

Learn more about how Sundstrand "Engineered Production" can solve your machining problems by writing for Bulletin 604 today.

BROACHING TOOLS BROACHING MACHINES PRESSES



SUNDSTRAND MACHINE TOOL
Div. of SUNDSTRAND CORPORATION
Belvidere, Illinois • U. S. A.

FOR PRODUCTION MACHINE TOOLS IT'S **ROCKFORD, ILLINOIS, U.S.A.**

Now... automation comes to shaping!

Full Automatic Cycling

For Conveyor-Line Operation

On New Rockford Hy-Draulic Shaper

Believed to be the first automatic shaper built, this standard 24" shaper with special tool head and cross-rail has been adapted to conveyor-line operation by arranging completely automatic cycling, including loading and unloading.

With this new method, many types of flat plates may be machined accurately and efficiently at high production rates, saving costly cutting tools and extra fixturing expense.

Four standard high speed steel tool bits with identical grinds are used to finish one vertical and one angular surface of each of 2 pieces simultaneously, as shown in diagramatic sketch of the automatic cycle. The machine features pneumatic index, hydraulic positioning and clamping, and positive mechanical feed. Operation is continuous until machine is stopped by operator, or automatic safety devices reject the cycle sequence.

This type of automatic machining has many variations, using Rockford Hy-Draulic Shapers. If you have high output requirements for work which lends itself to this type of machining, send us blueprints for estimates and recommendations.

h
HYDRAULIC

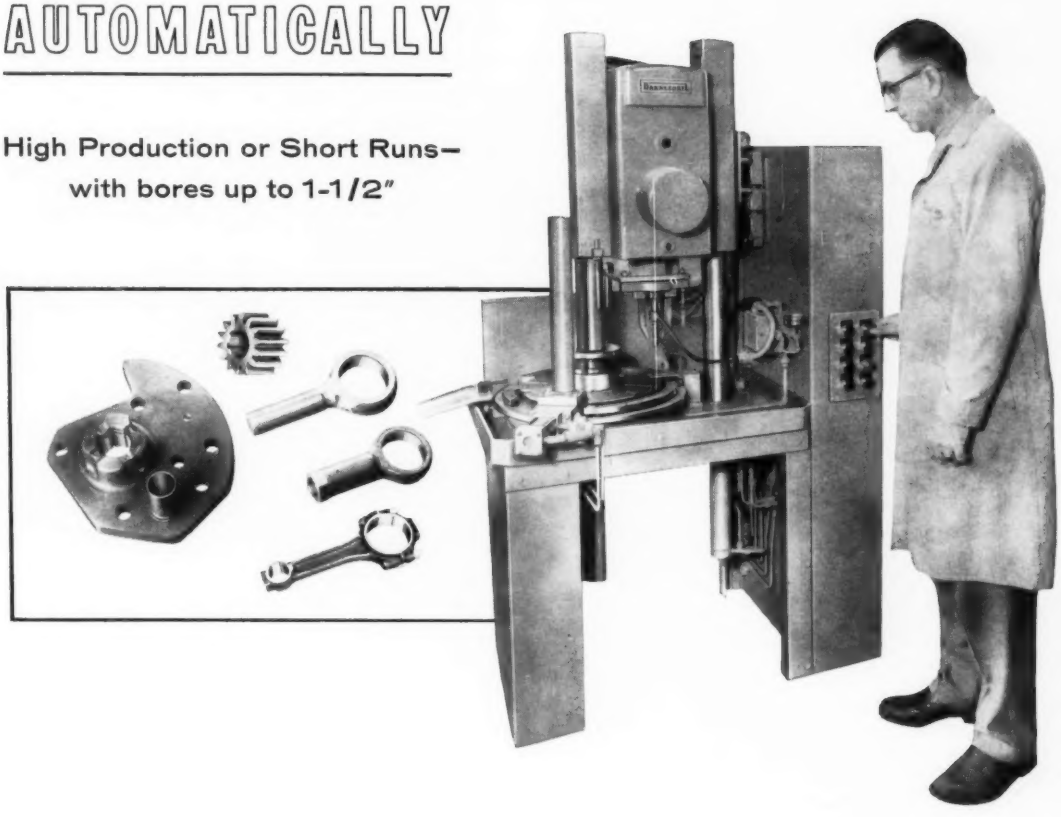
ROCKFORD MACHINE TOOL CO.

2500 KISHWAUKEE STREET • ROCKFORD, ILLINOIS

MACHINES DESIGNED TO MEET YOUR NEEDS **ROCKFORD, ILLINOIS, U.S.A.**

HONE SMALL PARTS
AUTOMATICALLY

High Production or Short Runs—
with bores up to 1-1/2″



This new No. 10 series of Single Spindle Vertical Honing Machines is designed with complete automation for handling small parts with bores up to 1½″. These machines are small and compact in size, highly accurate, and simple to operate. They are particularly efficient and economical for honing short production runs, as well as sustained high production work.

Design features include pneumatic hone expansion with automatic rapid expansion, feed and collapse of stones; automatic bore-to-bore sizing; magazine loading and automatic ejection. Automatic shut-down is also provided as honing stones become worn. Optionally, parts may also be automatically pre-gauged, honed, post-gauged, sorted and ejected.

Powered by an all mechanical system, these machines require very little maintenance. Rigidity and accuracy are assured through suspension of the reciprocating head between two columns.

For free estimates and complete information on application to your high-production small-part finishing operations, send blueprints to BarnesdriL engineers.

BARNES DRILL CO.
830 CHESTNUT STREET • ROCKFORD, ILLINOIS
DETROIT OFFICE: 13121 Puritan Avenue

FOR PRODUCTION MACHINE TOOLS IT'S **ROCKFORD, ILLINOIS, U.S.A.**

MATTISON
HIGH-POWERED PRECISION
GRINDING METHODS

Are you "overmachining" parts like these?

If you machine gear cases, inspection doors, and other simple pieces not requiring dimensional accuracy, you can grind and save time on a Mattison "No. 153."

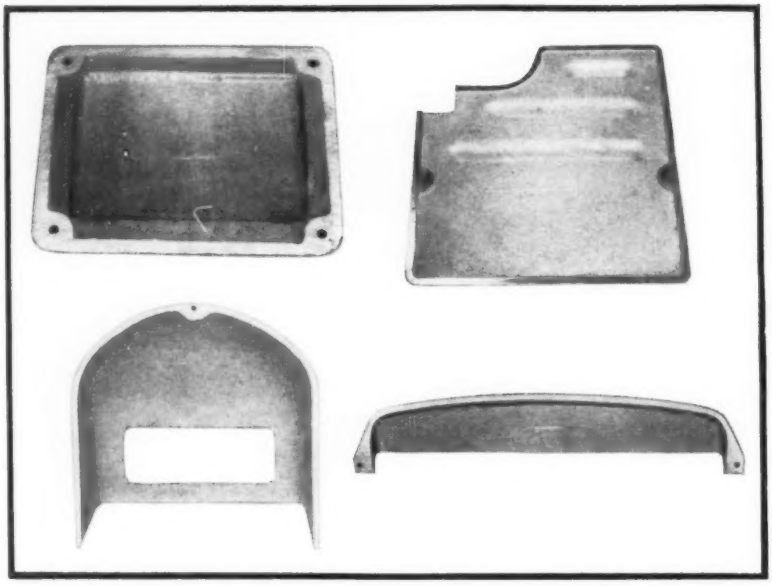
Any shop that uses cutter-type machining for low-tolerance parts can increase efficiency and reduce machining time with a general-purpose Mattison No. 153 vertical-spindle disc grinder.

In your foundry, on the assembly floor, or right in the production line, this versatile machine tool does a variety of jobs at surprisingly low cost . . . freeing your expensive equipment for other work.

Each piece is its own fixture . . .

The "153" eliminates time-consuming setups along with costly fixtures. On a tub grinder, the weight of the piece is all the clamping or fixturing you need.

What's more, you can quickly pregrind parts to be held on magnetic chucks for milling or finish grinding. Dimples, burned edges, and rough spots are removed easily and quickly—the smooth, flat surface increases holding power of the chuck, eliminates warpage, and promotes uniform accuracy.



Versatile tool for machinery builders . . .

The Mattison No. 153 gives machinery builders a versatile, cost-cutting tool, eliminates "overmachining" on aluminum and cast iron covers and plates. Sturdiness, smooth operation, and longer service life make it ideally suited for this type of work. Its 25-hp spindle motor, sturdy cast iron wheel dressing head, and heavy-duty thrust bearings (rated at 25,000 lb) are designed especially to satisfy the most rigid grinding requirements. And, a 53" dia. wheel with eight 1" or 2" segments make wheel handling easy and replacement possible at minimum cost.

Free method study

You can inspect, first hand, the value of Mattison's new Quick-Tilt surface grinder for machining your workpieces. Production tests show that the average grinding operation can be at least 50% more efficient with this new method. We will machine your parts in our Methods Laboratory and give you a complete job analysis which takes the guess out of grinding. There's no obligation—your Mattison dealer will make all arrangements.

MATTISON MACHINE WORKS
Rockford, Illinois • Phone WO 2-5521

MATTISON MACHINE WORKS
HIGH-POWERED PRECISION SURFACE GRINDERS

MACHINES DESIGNED TO MEET YOUR NEEDS **ROCKFORD, ILLINOIS, U.S.A.**

ALLEN-BRADLEY
Solenoid Starters give

MORE MILLIONS OF TROUBLE FREE OPERATIONS

... and for good reasons

• ONE MOVING PART

With this simple solenoid design, there's virtually nothing to go wrong—all trouble-causing bearings, pivots, and flexible jumpers have been eliminated.

• DOUBLE BREAK, SILVER ALLOY CONTACTS

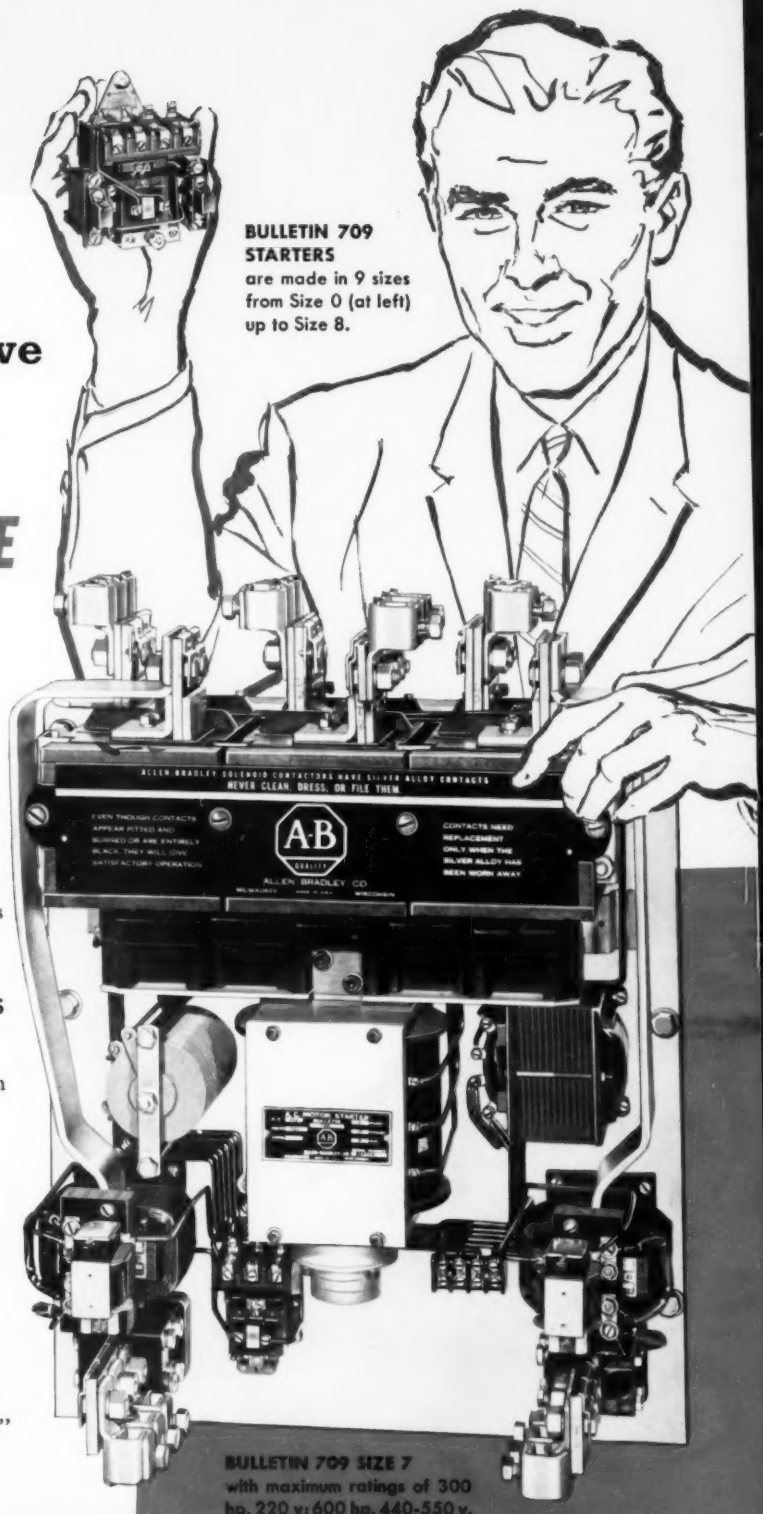
Allen-Bradley silver alloy contacts never require maintenance. They are always in perfect operating condition . . . and remain so until completely worn away.

• SIMPLE UP-AND-DOWN MOTION

The virtually frictionless, straight line vertical motion provides uniform contact pressure at all times—and assures consistent, rapid operation of the contactor.

• RELIABLE OVERLOAD PROTECTION

All A-B starters are equipped with two permanently accurate and reliable overload relays that protect motors against "burnouts." Three overload relays can be furnished.


A-B
QUALITY
ALLEN-BRADLEY SOLENOID CONTACTORS HAVE SILVER ALLOY CONTACTS
NEVER CLEAN, DRESS, OR FILE THEM
EVEN THOUGH CONTACTS APPEAR PITTED AND BURNED OR ARE ENTIRELY BLACK, THEY WILL GIVE SATISFACTORY OPERATION
A-B
QUALITY
ALLEN-BRADLEY CO.
CONTACTS NEED REPLACEMENT ONLY WHEN THE SILVER ALLOY HAS BEEN WORN AWAY

BULLETIN 709 STARTERS are made in 9 sizes from Size 0 (at left) up to Size 8.

BULLETIN 709 SIZE 7 with maximum ratings of 300 hp, 220 v; 600 hp, 440-550 v.

ALLEN-BRADLEY

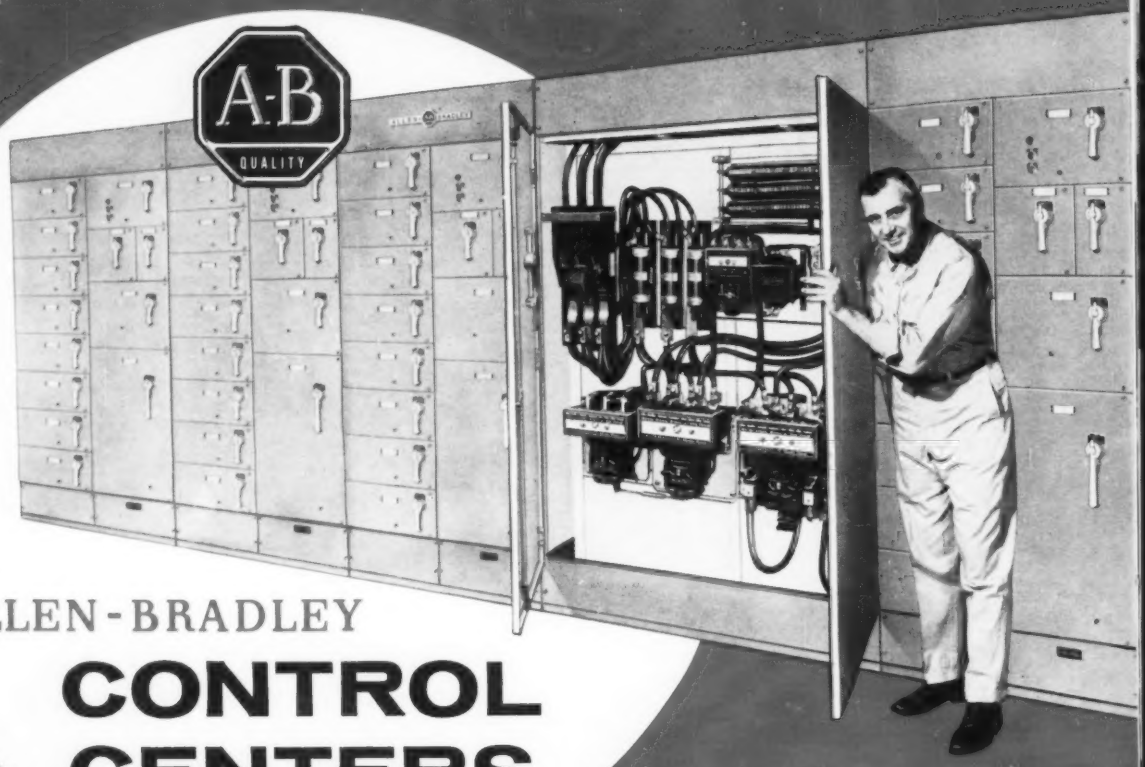
MEMBER OF NEMA

Allen-Bradley Co., 1316 S. Second St., Milwaukee 4, Wis.
In Canada: Allen-Bradley Canada Ltd., Galt, Ont.

QUALITY MOTOR CONTROL

6-59-MR

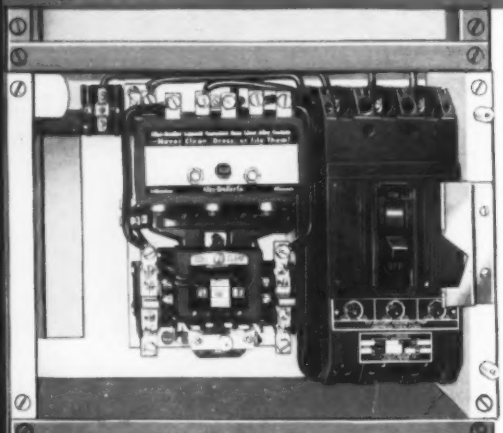
Advanced Design Features in a Control Center . . .



ALLEN-BRADLEY

CONTROL CENTERS

. . . offer tops in FLEXIBILITY • SAFETY QUALITY APPEARANCE



This typical unit of an A-B control center shows a Bulletin 709, Size 2 starter and an I.T.E. circuit breaker.

Allen-Bradley control centers are the "label" of a modern plant. They make neat, centralized installations and—where this is practical—do away with individual starter mountings and complicated wiring. The control center may even reduce installation cost—as compared with using individual starters. Here are some of the up-to-date design features which make the A-B control centers so popular.

NEW SPACE SAVING DESIGN—New Bulletin 798 control centers save floor space . . . provide up to 8 units in a 90" high control center unit.

PREMIUM QUALITY FINISH—An exclusive A-B finishing process assures that your control center will retain its attractive appearance over the years. Each piece is *individually* cleaned and phosphated *before* assembly—there are no "bare spots" where corrosion can have a start. Then a rust-resisting primer and a dense finish coat are baked on, providing a fine, tough, and lasting surface.

FLEXIBILITY—A-B control centers are readily adaptable to changes in operating needs—integral plug-in units can be added or modified without internal rewiring. Entire sections are easily added as needed.

SUPERIOR PERFORMANCE—Using the popular A-B solenoid starter—with only ONE moving part—assures millions of trouble free operations. Their double break, silver alloy contacts *never* need servicing.

For "tops" in control centers, you owe it to yourself to investigate Allen-Bradley's Bulletin 798. Write for complete information.

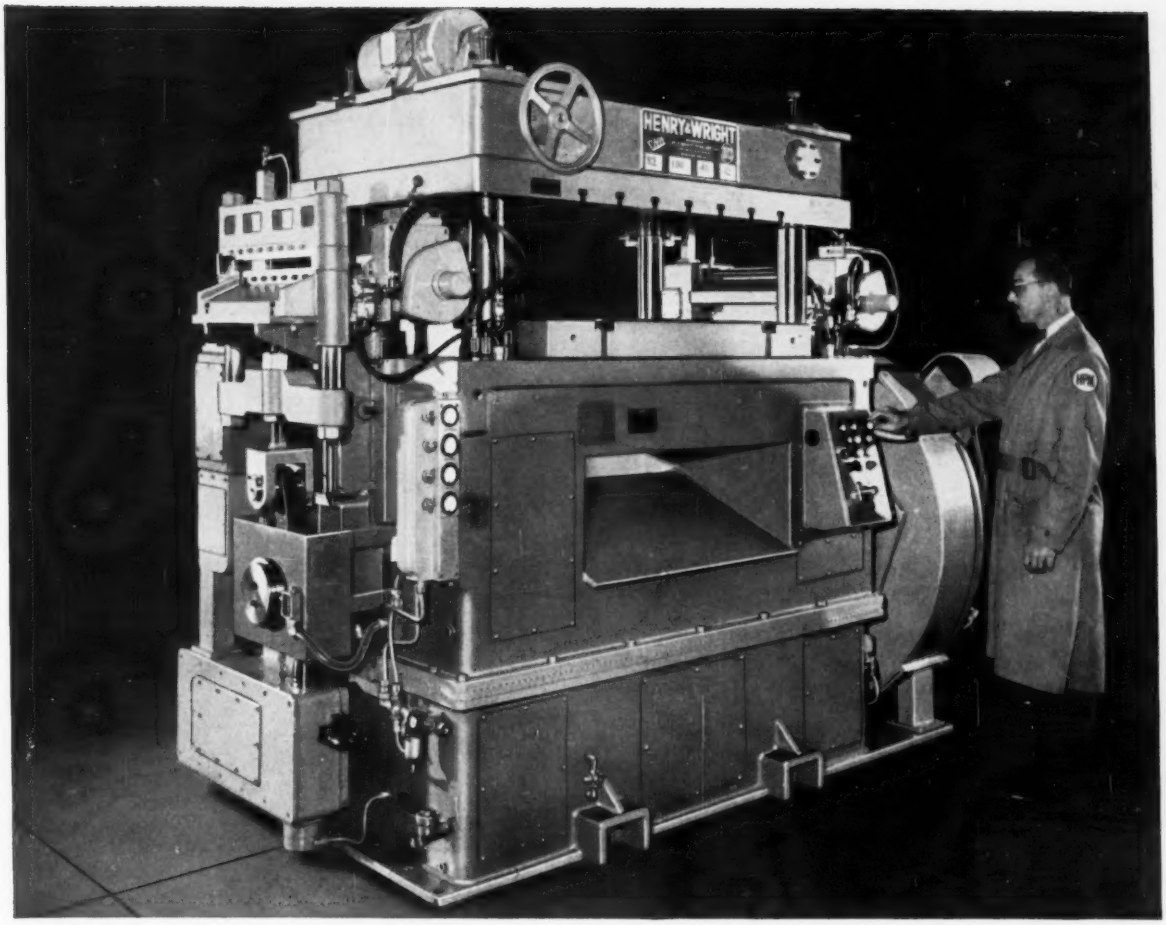
ALLEN-BRADLEY

MEMBER OF NEMA

Allen-Bradley Co., 1316 S. Second St., Milwaukee 4, Wis.
In Canada: Allen-Bradley Canada Ltd., Galt, Ont.

6-59-MR

QUALITY MOTOR CONTROL



DOUBLE DIE-LIFE, DOUBLE PRODUCTION OUTPUT

with Henry & Wright Double-Crank Dieing Machines

The advantages of progressive stamping are adaptable to many everyday stamping jobs through Henry & Wright double-crank dieing machines. Four basic advantages place H & W's in a new competitive position:

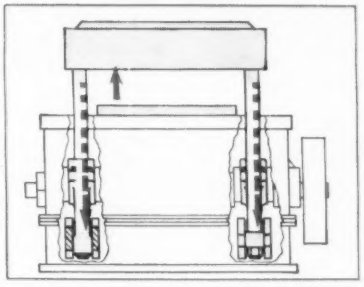
(1) Form larger parts on lower tonnage machines with double crank design;

(2) provides greater precision and longer die life;

(3) overall height is reduced to about half that of conventional straight side presses — less head room required;

(4) they're more compact; sizes to 150-ton do not require a pit. Operator sees entire die bed while standing at controls.

Add these major production advantages to a design that reduces maintenance through automatic safety controls and the popularity of the new H & W's is quickly understood. Here's where you benefit:



• All principal bearings are lubricated by a motor-driven recirculating oil system, sealed against contaminants.

• Crankshaft bearings are thermal-switch controlled. Press cannot operate except within safe temperature limits.

• Lower base is insulated against vibration and pounding.

• Discharge chutes are conveniently located for stackers or automatic conveyors.

• Air pressure is used on the feed rolls instead of springs. Easier to adjust, release, last longer. Feed pitch can be changed while machine is in operation.

• Dies may be inserted from front or rear without moving roll feed. Faster die set-ups save valuable time.

The ability to properly handle off-center loading with more uniform distribution of applied force is probably the greatest advantage for large stamping production. Greater accuracy, better quality and longer die life are natural results. Find out about these new, cost-reducing dieing machines. Write for new Catalog.

HPM

H-936

THE HYDRAULIC PRESS MFG. COMPANY

A Division of Koehring Company
Mount Gilead, Ohio, USA

For more data, circle this page number on inquiry card

***Experience**—the added alloy in **Allegheny Ludlum** tool steels*

Careful addition of sulfur to melt guarantees typical sulfide distribution, as shown in photomicrograph of longitudinal specimen of EZ MACHINING tool steel.

Sulfur addition to melt held to narrow range in Allegheny Ludlum's EZ MACHINING GRADES

Uniform, finely-distributed sulfides mean uniform machining, uniform high finish, uniform long tool life order after order

Adding sulfur, actually an impurity, to a tool steel melt to make it free-machining must be done with care and precision. That's why Allegheny Ludlum maintains an extremely close average range in adding sulfur to its EZ MACHINING grades. But mere range, however narrow, is not enough. A-L has developed special techniques in adding sulfur and nucleating agents to produce the uniform, finely-distributed sulfides that characterize good free-machining tool steels.

A-L's extra care means you can standardize your machining operations from piece to piece and order to order. This reproducibility is reflected in uniform *machining;* uniform *high finish;* uniform *long tool life.*

For example, in the production of hobs these machining properties in Allegheny Ludlum's EZ MACHINING steels minimize the costly "backing off" operation for back clearance of multiple teeth, eliminating complicated extra heat treatment. Lower residual stresses are set up, because the steel has a lower resistance to the cutting action. Naturally, hobbing is only one of the situations where these free-machining characteristics can benefit you.

Allegheny Ludlum stocks a complete line of tool steel sizes and grades. Call your nearest A-L representative; you'll get quick service and counsel on such problems as heat treating, machining, grade selection, etc. Or write for A-L's publication list which gives full data on the more than 125 technical publications offered. They'll make your job easier.

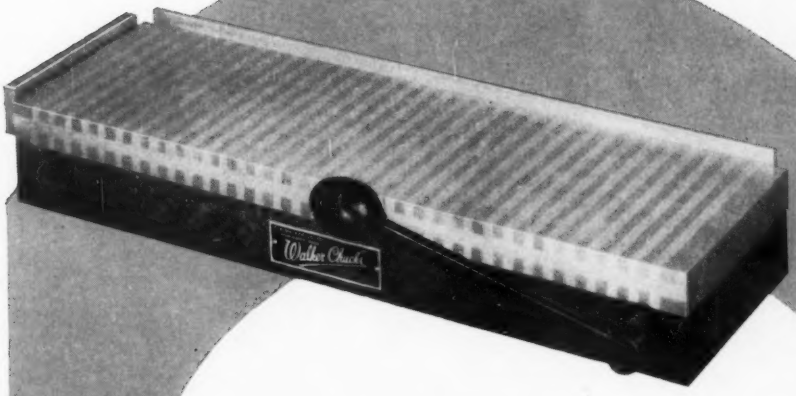
ALLEGHENY LUDLUM STEEL CORPORATION, Oliver Building, Pittsburgh 22, Pa. Address Dept. M-18

WEW 7283

ALLEGHENY LUDLUM

Tool Steel warehouse stocks throughout the country... Check the yellow pages

every grade of tool steel... every help in using it



Finest, Most Complete Line of Permanent Magnetic Chucks*

O. S. Walker offers the world's finest chucks – both rectangular and rotary – in a full range of sizes. Their magnets are the most permanent magnets ever produced! They're ceramic, with many times the coercive force of alloy magnets. The face of every chuck is *all steel* (no soft insulating material). Other important features: 50% less weight; low, low height; fine pole divisions for maximum holding power; easy "on-off" lever, with complete demagnetization in "off" position. Write for catalog.

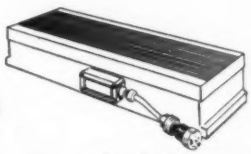
*Patents Pending

O.S.Walker

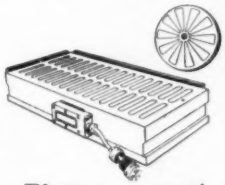
O.S. WALKER COMPANY, INC.
WORCESTER 6, MASS.

O. S. Walker – The Original Designers and Builders of Magnetic Chucks!

Special vacuum chucks for holding non-ferrous parts



Bar pole electro-magnetic chucks in 81 sizes



Electro-magnetic chucks in 172 sizes

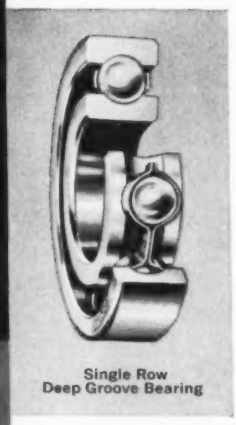
Special electro and magnetic chucks and magnetic holding fixtures

Standard and special demagnetizers

For more data, circle this page number on inquiry card

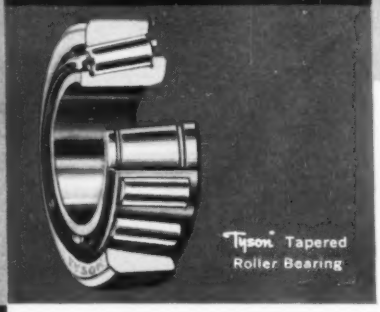
What's "special" about these standard SKF bearings?

*Cylindrical Roller Bearing



Single Row Deep Groove Bearing

Spherical Roller Bearing



"Tyson" Tapered Roller Bearing

Spherical Roller Thrust Bearing

Angular Contact Bearing

They all have exclusive features. Where else, for example, can you get the 33⅓% higher capacity available in standard SKF spherical roller bearings?

*Or, take the cylindrical roller bearing. This type provides high radial capacity and minimum shaft friction. Controlled shaft end float within the bearing is a natural advantage of this design.

Yet this is SKF's standard cylindrical roller bearing, promptly available in 154 sizes ranging from just under 1" to 6" (bore). In the double row it's 1" to 9.5".

Why not get the complete facts on these "special" but standard (and economical) bearings? For details, call any of the 25 SKF sales offices today. 5923

Spherical, Cylindrical, Ball, and "Tyson" Tapered Roller Bearings

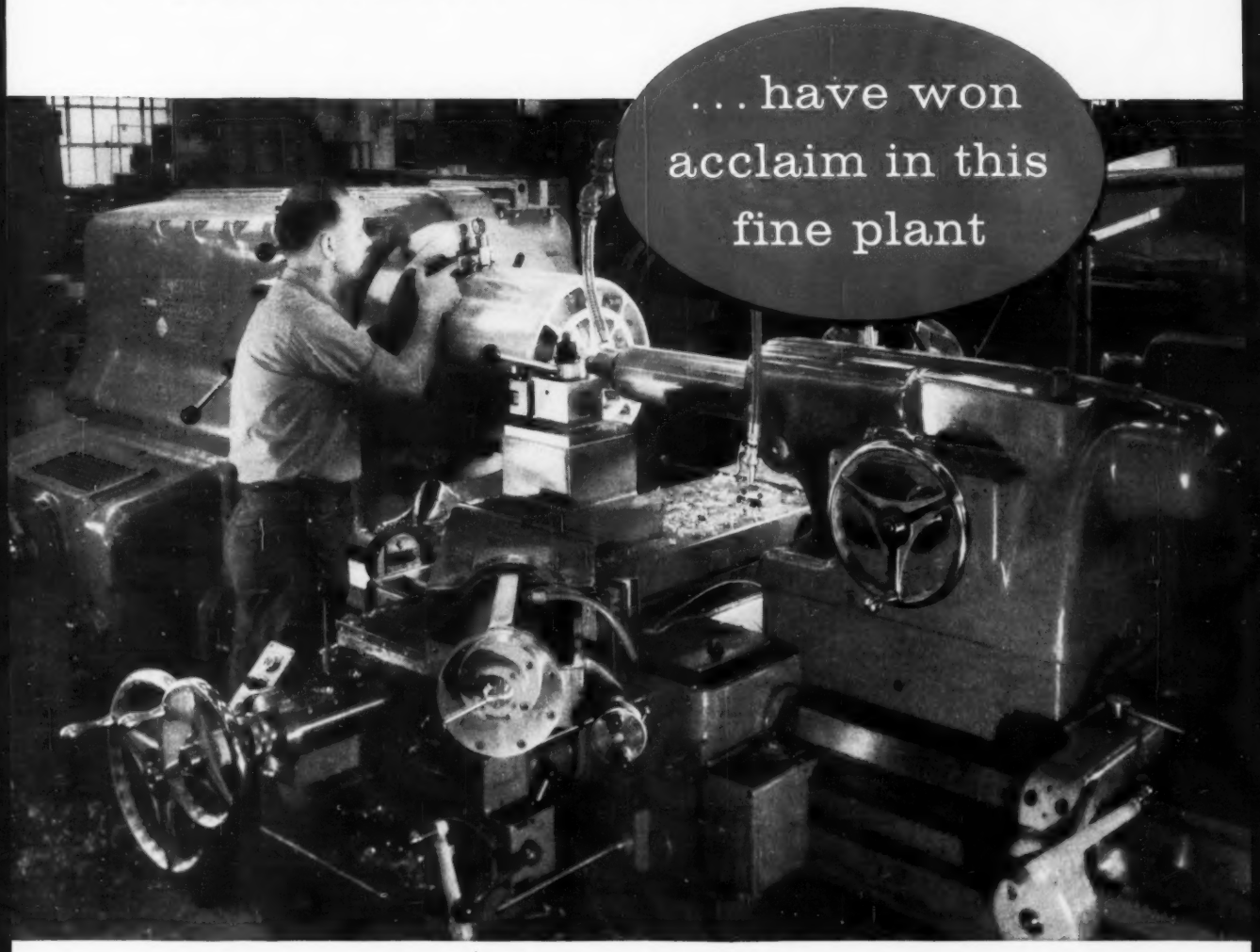
EVERY TYPE—EVERY USE

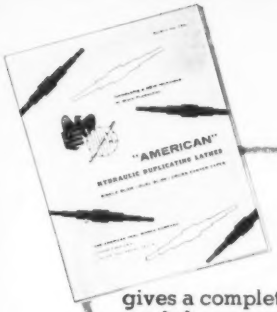
SKF®

SKF INDUSTRIES, INC., PHILADELPHIA 32, PA.

*REG. U. S. PAT. OFF.

"American" TRACER LATHES





Bulletin No. 135

gives a complete description and shows many examples. It's yours for the asking.

The Mechanical Division of General Mills, Inc. in Minneapolis, Minnesota uses "AMERICAN" Tracer Lathes for their contouring work. 17 years of ordnance and instrument work have conclusively demonstrated to the General Mills officials that only the highest quality equipment can produce the precision work that their contracts require—result "AMERICAN" selection.

More production per man hour is the answer and only answer to spiraling costs—modern, high production machinery is the answer to greater production per man hour. Judging from reports, the Mechanical Division of General Mills, Inc. has found this to be true.

THE AMERICAN TOOL WORKS CO. Cincinnati 2, Ohio, U. S. A.

LATHES AND RADIAL DRILLS

For more data, circle this page number on inquiry card

SPARE PARTS ARE RARE BIRDS

because...

WILLIAMS SUPERJUSTABLES® LAST and LAST and LAST

Superjustable® Wrenches are available in Regular or Locking styles with chrome or black finish. Made in 4, 6, 8, 10, 12, 15, 18 and 24 inch sizes.

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J. H. WILLIAMS & CO.

DIVISION OF UNITED-GREENFIELD CORPORATION

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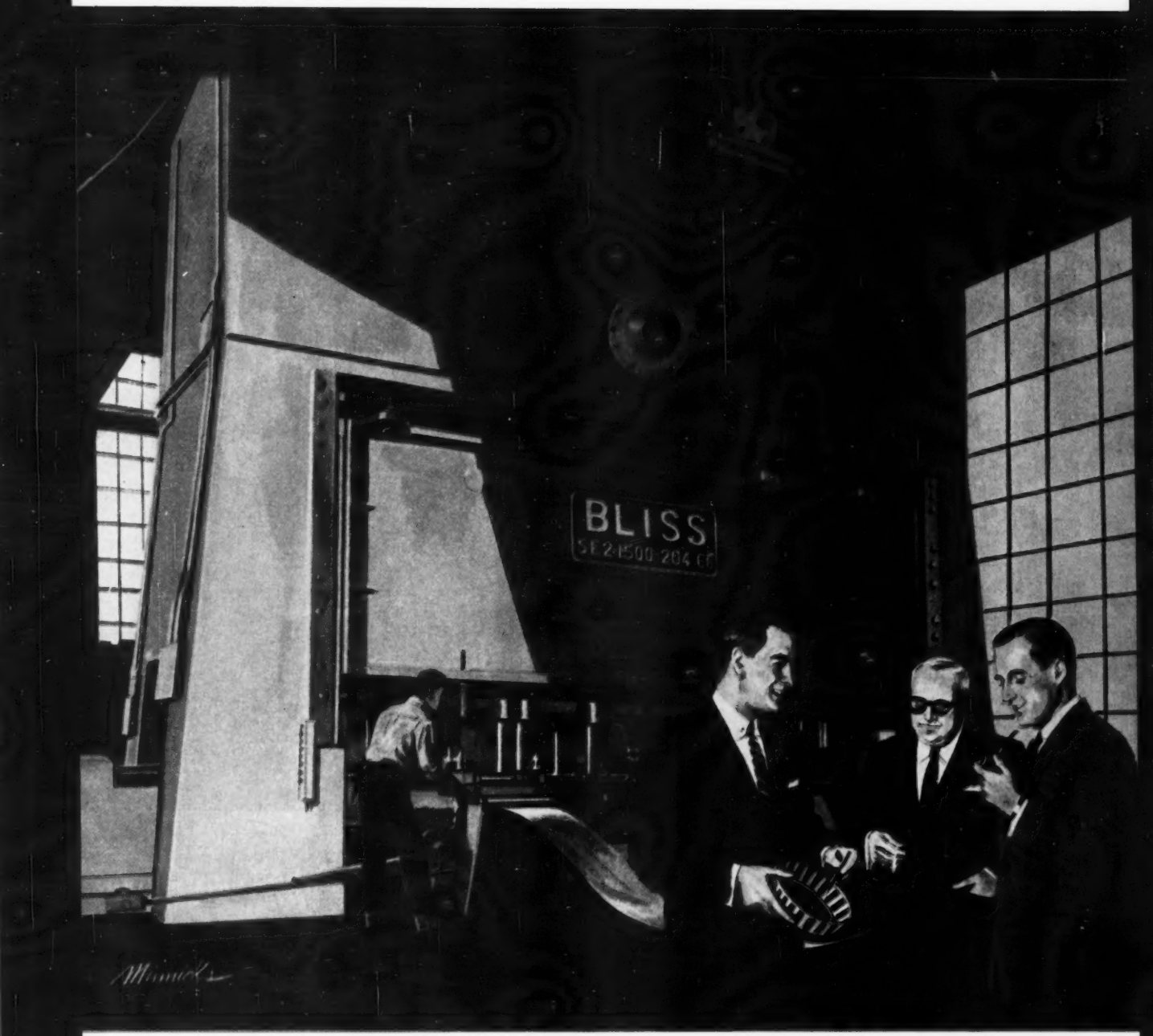

"Our new Bliss makes 16 of these a minute...

...direct from coil stock." Automating bearing cage production was a key objective of the modernization program recently undertaken by The Timken Roller Bearing Company. And close cooperation between Bliss transfer feed specialists and Timken production men resulted in a press that does the work of a number of older ones—it automatically feeds heavy gage coil stock in and finished cages out—sixteen of them every minute. If more parts for less money is your pressing problem then by all means send for our illustrated transfer feed bulletin. It's packed with some unusual applications of the transfer principle. Perhaps there's an idea here for you...

BLISS
SINCE 1857

E. W. BLISS COMPANY · Canton, Ohio

BLISS is more than a name—it's a guarantee

PRESSES • ROLLING MILLS • ROLLS • DIE SETS • CAN MACHINERY • CONTRACT MFG.

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Complete DRILLING

versatility

for the "cumbersome" parts... with U. S. DRILL HEADS

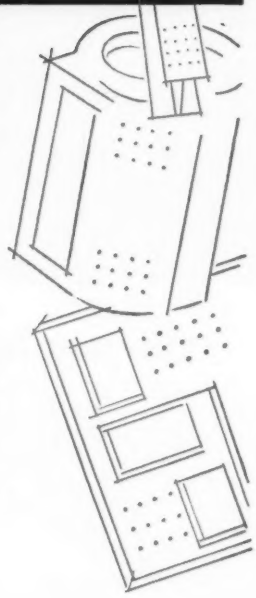
- ☐ Full ball bearing mounting of shafts
- ☐ Shaved gears throughout
- ☐ Exclusive quick-change neoprene-sealed universal joints
- ☐ Heavy duty spindle assemblies
- ☐ Adjustable-arm spindle mounts, or special bored Slip Spindle Plates
- ☐ Oil-tight, high-strength cast housings

Is your drilling *accurate and economical* in structural steel, tube sheets, flue sheets, and other large, cumbersome parts? It will pay you to check into a U. S. Drill Head installation on your radial drill!

Style U Universal Joint Adjustable Heads equipped with Air Counterbalance and 360° Ball Bearing Swivel Attachment give added versatility to any radial drill. Quick setup with positive lock of swivel in aligned position. Fast and accurate operation with minimum operator fatigue.

Select the *right* head for your jobs from the many sizes of Style U Heads. You'll get lots of cost-reducing features.

Write for descriptive literature, or ask for recommendations on your particular multiple drilling problems.



US DRILL HEAD

Adjustable and Fixed Center Multiple Drilling Heads.
Individual Lead Screw Multiple Tapping Heads.

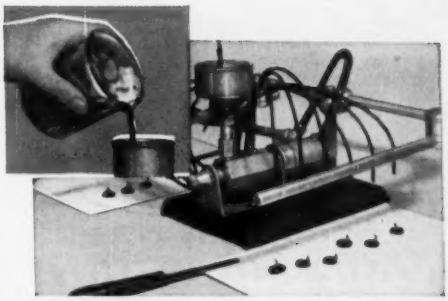
UNITED STATES DRILL HEAD CO.

BURNS STREET • CINCINNATI 4, OHIO

Bertsch & Co. finds solution to lubrication problem... with Standard Oil's

RYKON Grease R

Centralized lube system pumps grease through 80 ft. lines in cold temperature; no clogging



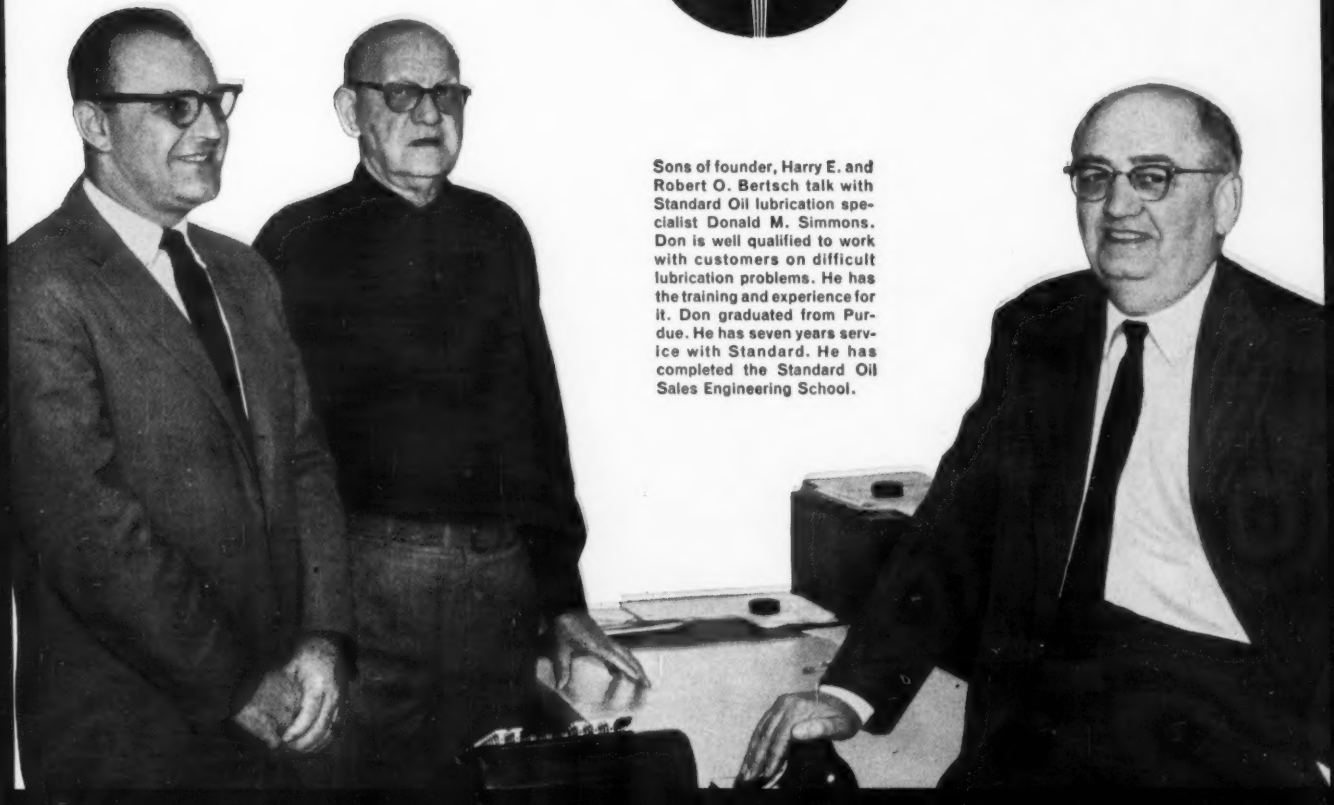
Lab demonstration shows how RYKON Grease R works. Grease is poured into reservoir as a fluid. The shearing action exerted by pump and outlets irreversably converts fluid to a grease. Grease is ejected from outlet lines.

Problem: Bertsch & Company, Cambridge City, Indiana, makes pinch rolls and other metal bending equipment. A centralized lubrication system used on one pinch roll model had to pump grease 80 feet. Greases tried could not be pumped this distance without clogging lines. Since machines are shipped all over the world and are often in operation in cold climates, Bertsch had additional problems. The grease had to be pumpable in cold temperatures. It had to be foolproof so that customers beyond the reach of service calls would experience no problems.

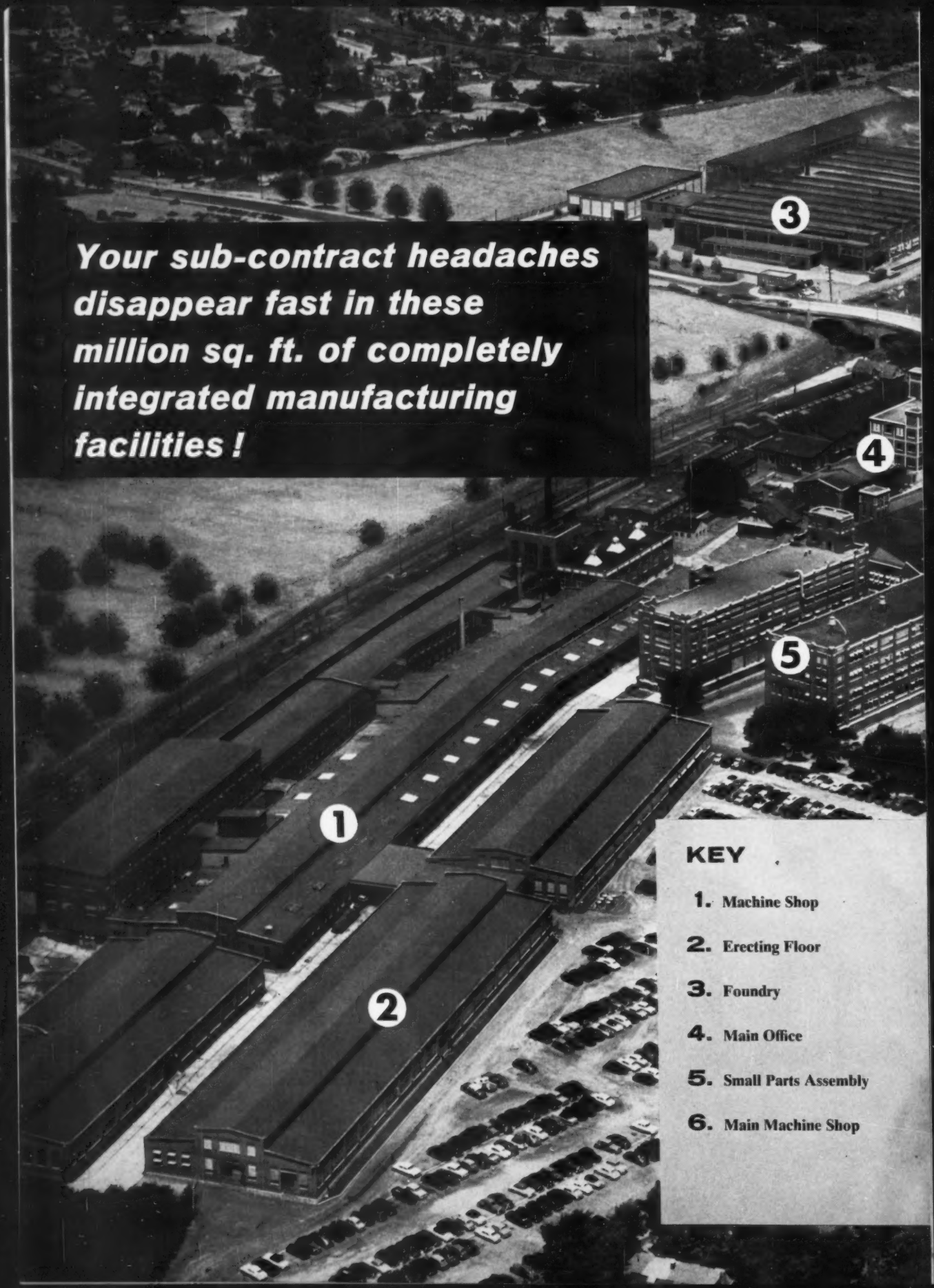
What was done: Bertsch turned to Standard Oil for help. Standard Oil man, D. M. Simmons had the answer: RYKON Grease R. This is a rheopectic grease, one that flows like an oil. Its rheopectic properties cause it, under slight shearing stresses, to turn to a thick, durable grease. RYKON Grease R flows to the pump as a fluid, lubricates the bearings as a grease.

What you can do: Maybe you manufacture equipment that needs a centralized lubrication system and you have been looking for a grease like RYKON R. Get the facts about RYKON Grease R from your nearby Standard Oil lubrication specialist anywhere in the 15 Midwest and Rocky Mountain states. Or write **Standard Oil Company (Indiana), 910 South Michigan Ave., Chicago 80, Illinois.**

You expect more from STANDARD *and you get it!*



Sons of founder, Harry E. and Robert O. Bertsch talk with Standard Oil lubrication specialist Donald M. Simmons. Don is well qualified to work with customers on difficult lubrication problems. He has the training and experience for it. Don graduated from Purdue. He has seven years service with Standard. He has completed the Standard Oil Sales Engineering School.


Your sub-contract headaches disappear fast in these million sq. ft. of completely integrated manufacturing facilities !
3
4
5
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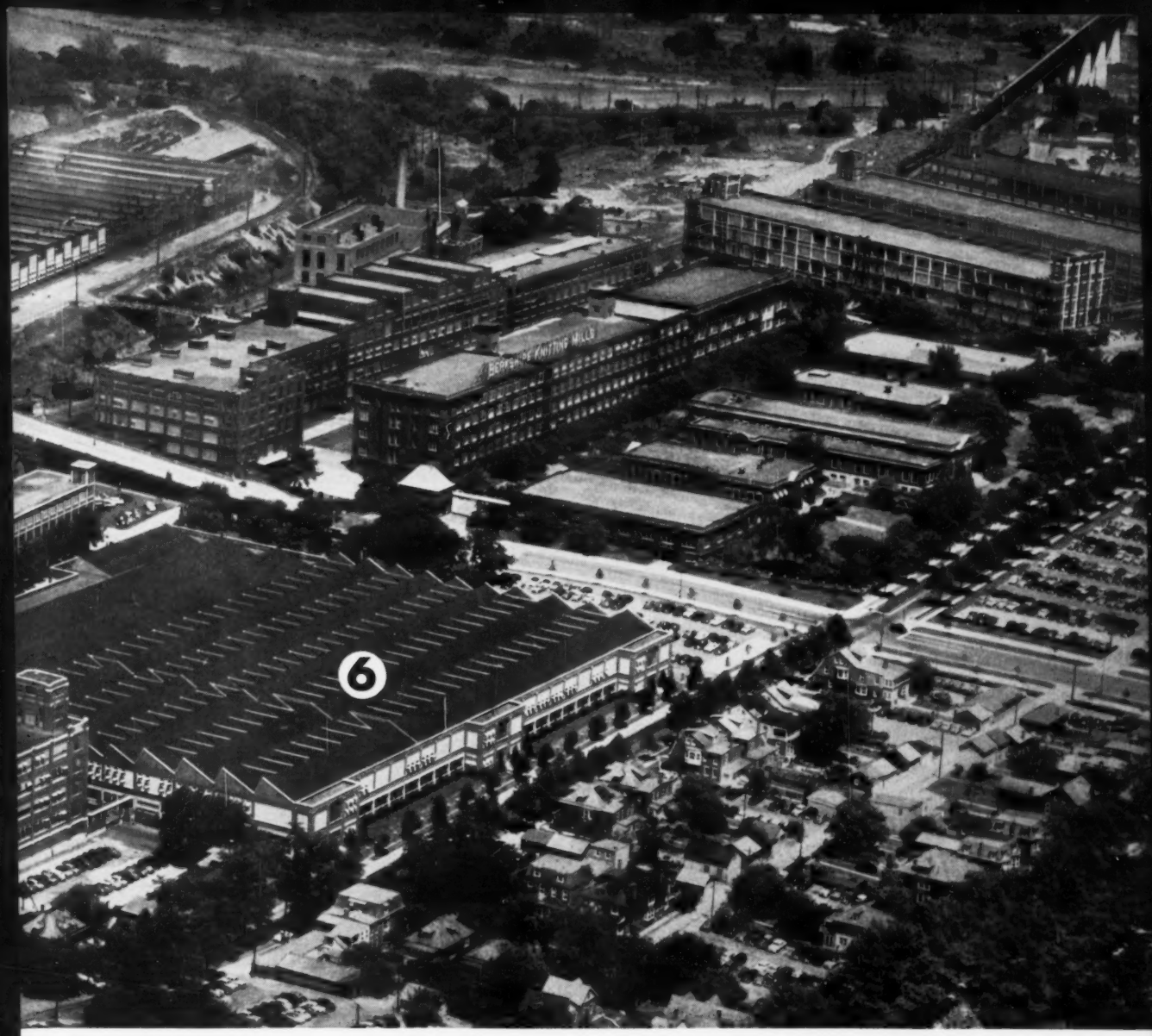
2
KEY
1. Machine Shop
2. Erecting Floor
3. Foundry
4. Main Office
5. Small Parts Assembly
6. Main Machine Shop



Nothing's quite so important in sub-contracting as *single* responsibility . . . one single responsible source that you can depend on for quality, accuracy, and on-time delivery of your components, assemblies and complete machines.

You get all this when you work with one of the world's largest, most modern and completely integrated manufacturers, whose 65 years' experience in precision (tolerance to 10ths) manufacturing is available to you *now*, on either a short or long-term basis.

Textile Machine facilities include 1200 *modern* machine tools of all types and sizes, a completely mechanized foundry (one of the country's largest), 3000 skilled craftsmen, including a corps of the industry's top designers and engineers.

Combine these facilities with electronic punch card production scheduling controls and quality control techniques—and you've got the perfect answer to all your sub-contract problems . . . right *under one roof*.

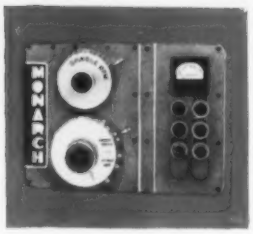
For more details, or for latest Facilities File Folder, call or write:

TEXTILE MACHINE WORKS

Contract Division • Reading, Pennsylvania

the Monarch gage for

THE HEADSTOCK THAT THINKS... AND REMEMBERS



1. 36 speeds—range 14 to 1750 R.P.M.—ratio 1 to 125. Standard range low enough, high enough and with plenty of speeds in between to provide reasonably constant surface cutting speed on most work.

2. Optional extra-high speed range of 25 to 2500 R.P.M. available for free cutting metals such as aluminum and for ceramic tooling requirements.

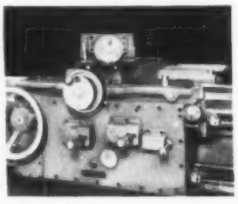
3. Operator works in terms of surface cutting speed. Machine automatically figures correct R.P.M. and sets up shift. Operator sets two large dials—one for work diameter, the other for desired surface speed.

4. Using the two-dial preselector, up to six or more different speed changes may be preset while machine is under cut. This saves speed change time when turning successive diameters having considerable variation or when finish turning immediately follows rough turning. The second dial always indicates spindle speed in engagement.

5. Pull of knob gives free spindle in a jiffy. And there is a generous $2\frac{1}{16}$" hole through the spindle.

6. Hydraulic brake and clutch are self-adjusting for wear. Being under automatic machine control regardless of load, operator need not supply power for engagement.

THE CONTROL CENTER OPERATORS LIKE



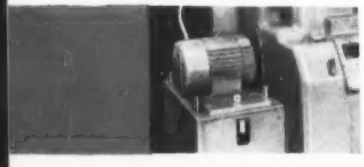
1. Series 62 is controlled by a three-position lever at the apron. A duplicate lever close to the headstock is provided for setup purposes. With it, work rotation may be started or stopped, jogging or speed change may be accomplished. In the SPEED CHANGE position the next speed is engaged automatically when preselection is used.

2. Shifting (an operation performed many times each day) is at finger-touch ease and speed. Hydraulic power does the work of clutching, braking, shifting and jogging.

3. Four-way power rapid traverse is in-built. Both carriage and cross slide traverse may be engaged simultaneously. This saves as much as 50% in tool adjust time.

4. Positive cam controlled feed frictions. Application is such that machine never loses its chip under heavy cuts.

5. Apron or headstock controlled leadscrew reverse, the former a must when much thread chasing is done.



ELECTRICALS WHERE THEY SHOULD BE

1. External main drive motor mounting and external electrical control mounting (either NEMA or JIC) for quick accessibility.

2. Motor mounted on hydraulic system sump from which position it also supplies power for hydraulic pump.

How do your lathes measure up? You get what you pay for in the purchase of a lathe, as with anything else. Greater production, therefore lowered costs, is the major reason for acquiring a new machine. That's what you get in the Monarch Series 62 Dyna-Shift—the only lathe of its general type which can be kept under full load during the entire machining cycle. Major contributing factors design-wise are more machine output per unit of power input, less operator effort, reduced maintenance and ease of supervision. See for yourself why the Series 62 meets all these requirements as does no other lathe on the market.

Users have found that these features and advantages have translated themselves into production increases of 25% or more and tool life improvement up to as much as 50%. And that's the pay-off. When you are ready to invest in a new lathe, buy the best. It's the cheapest in the long run.

THE MONARCH MACHINE TOOL COMPANY
SIDNEY, OHIO

COMPLETE AUTOMATIC LUBRICATION

1. Headstock, end gearing and gear box served by single system of the filtered, combination mist-splash type.

2. Apron lubrication system of the circuited, metered and filtered type also provides oil to carriage guide ways and cross slide bearings.

3. Tailstock has its own lubrication system.

INTERLOCKS FOR SAFETY

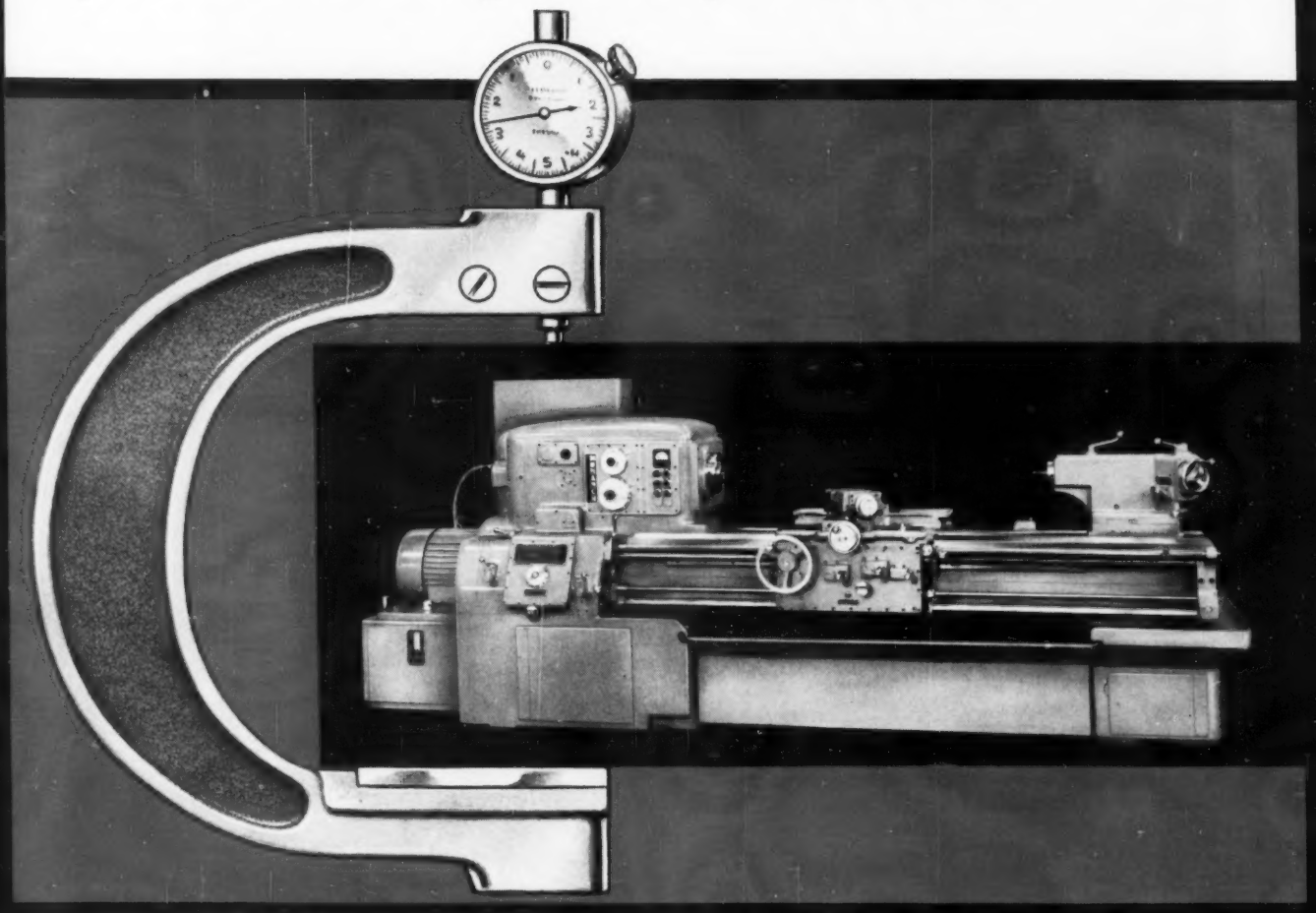
1. When machine is started, the brake engages automatically, preventing spindle rotation regardless of main control lever position.

2. No speed shift can be made with spindle rotating. More than anything else this preserves the original accuracy of headstock gearing.

3. Leadscrew and feed rod cannot be engaged simultaneously; neither can feed and power rapid traverse.

4. Leadscrew reverse cannot be engaged with spindle rotating above 340 R.P.M.

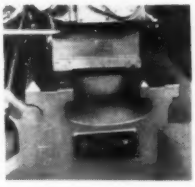
series 62 lathe–
productivity and precision



PROTECTED GEAR BOX AND END GEARING

1. Gear box and end gearing totally enclosed. Lubrication is kept in, dirt kept out, original accuracy maintained.

THE BED...A FIRM FOUNDATION



1. All four bed ways flame hardened and precision ground to keep them factory-fresh for years to come.
2. Generous size chip pans are designed for easy chip removal at front or rear.
3. Longer machines equipped with traveling rod supports which are automatically picked up and dropped off by apron.

TAILSTOCK THAT MEANS BUSINESS

1. Either single speed or two speed range type available with dead or anti-friction center spindle. Sufficient mass and rigidity to support the heaviest of cuts.
2. Movement along bed manually or by power. This combination satisfies all turning conditions.

SUPERVISORY PROBLEMS SIMPLIFIED

1. At a quick glance, supervisor may check (a) work diameter setting, (b) SFPM setting and (c) H.P. consumption. This makes it possible easily and quickly for him to assure full productiveness of machine and operator at all times.

ADDED EQUIPMENT FOR ADDED PRODUCTION

1. Additional equipment in vast variety is available for the Series 62 line. Consider, by all means, the advantages of the "Air-Gage Tracer," a means by which thousands of users have reduced costs substantially.
2. Ask for descriptive booklet No. 1506 which not only describes the basic machine but the commonly used items of additional equipment. It includes full specifications.

Monarch
TURNING MACHINES

SIMONDS
ABRASIVE CO.

DIAMOND WHEELS

Finest Quality for Carbide Tool Grinding

MAN-MADE OR NATURAL DIAMONDS

Precision made for best grinding performance . . . a product of the most modern manufacturing using latest techniques and most accurate equipment and tools, including air gauges. Highest mechanical accuracy, closest tolerances and balance for best running truth. Three-stage curing process assures closest duplication. Exact and true concentrations.

Man-made or natural diamonds in resinoid and vitrified bonds — metal bond in natural diamonds. Up to 35% improved grinding ratios regularly obtained with man-made diamonds on many applications.

Send for new, complete 48-page catalog with consumer net prices for all sizes, shapes, concentrations and diamond depths, form ESA 290.

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Write us for technical article reprinted from *Grinding & Finishing.*

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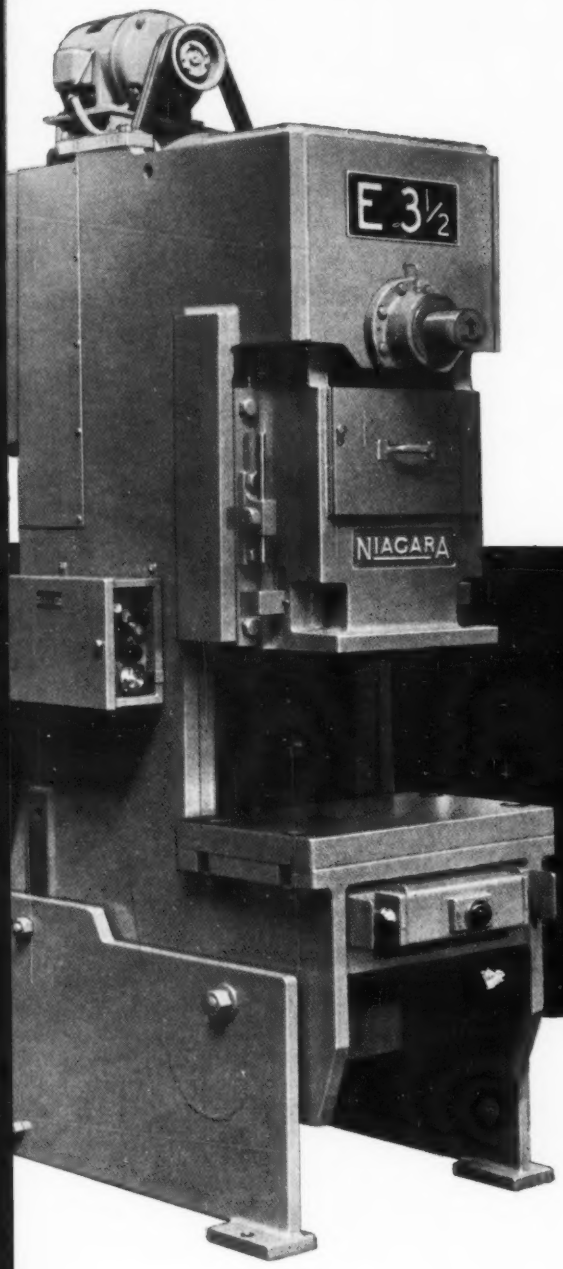
NEW! ULTRA-MODERN 45-TON OBI

added to Niagara's exclusive front-to-back crankshaft series



READY FOR YOU

. . . a brand new addition to industry's most advanced line of OBI's! Years ahead of any press within its range, this 45-ton newcomer is available plain or geared. The front-to-back arrangement of its 3½" crankshaft is, of course, a distinguishing mark of Niagara's famous Series E.

No other OBI press design has been so widely acclaimed. And no wonder . . . for no other OBI boasts so many unique advantages:

Full support to wide dies. Greater resistance to off-center loading. Accurate alignment of slide with minimized tendency to cock. Crankshaft deflection minimized. Substantially increased die life. Smoother, safer performance. Exposed overhanging gears, flywheel and other mechanisms eliminated. Less floor space.

GET THE FULL STORY on this new 45-ton wonder-worker as well as the 4 other sizes in the Series E family (up thru 200-ton capacities, and 7½" shaft diameters, standard and automated models). Write for illustrated Bulletin 56.

NIAGARA MACHINE & TOOL WORKS, BUFFALO 11, N. Y.

- Rigid crankshaft with close coupled main bearings each side of crank pin.
- Widest spaced OBI gibbing (L to R) in the industry permits wider box section slide to rigidly support a greater slide face area of full JIC dimensions. Guiding of slide is closer to point of die operation because there is no flange interference with gibbing.
- Longest gibbing in the industry, exclusive multiple "V" type, provides the most efficient guiding and accurate alignment of slide for greatest die life.
- Fully concealed, yet readily accessible, driving mechanism.
- Enclosed, rigidly supported gearing operates in sealed oil bath.
- Low inertia, pneumatic friction clutch and brake operate directly on crankshaft — the slowest rotating shaft.
- Precision, hardened, longer-wearing steel gears.
- Rigid, compact all-steel, box type frame.
- Power slide adjustment and power inclining device operate with new, unequaled speed.

NIAGARA

OBI PRESSES SERIES E

DISTRICT OFFICES: Boston • Buffalo • Cleveland • Detroit • Indianapolis • New York • Philadelphia / Distributors in principal U.S. cities and major foreign countries.

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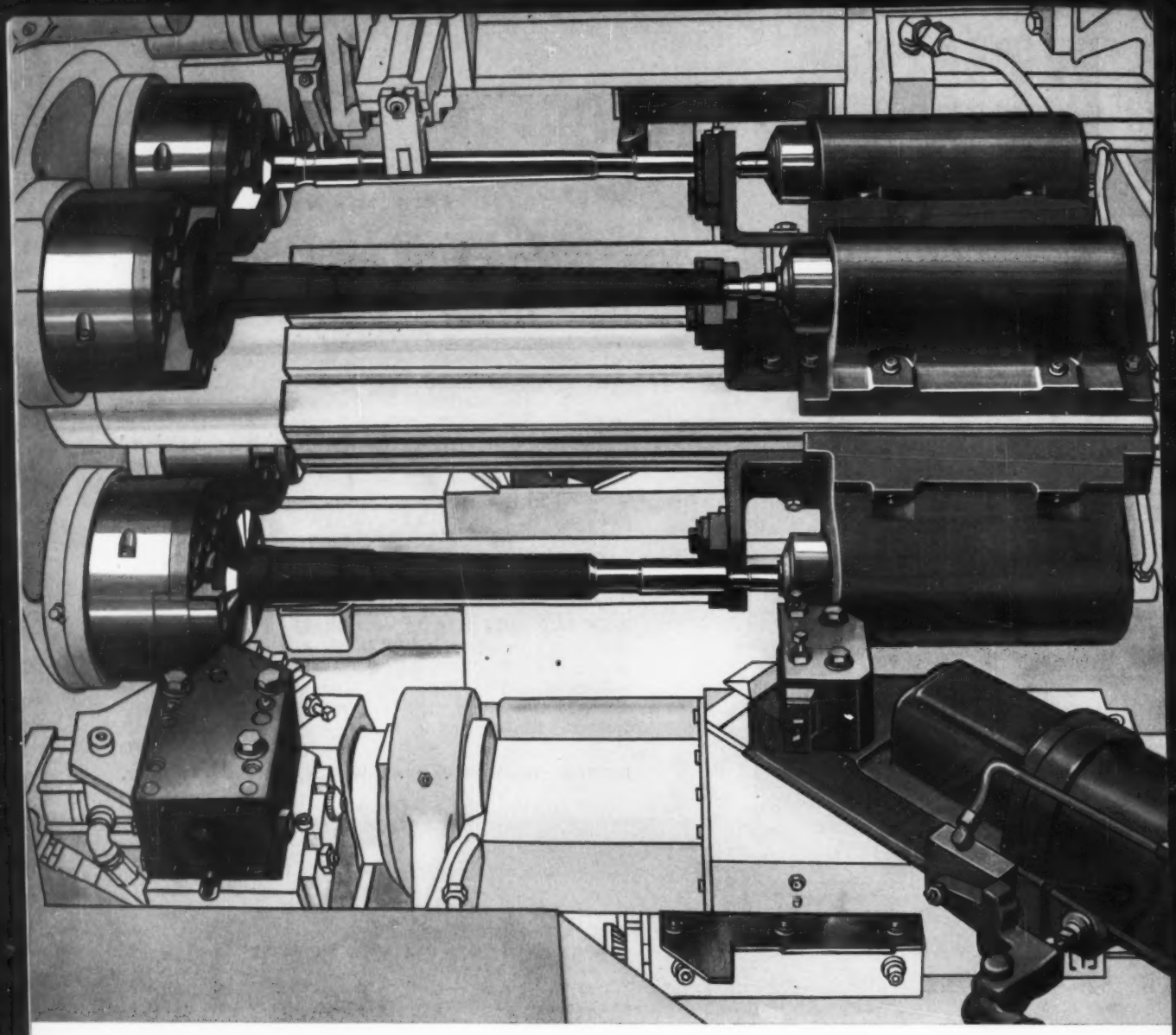


idea *for volume producers of shafts*

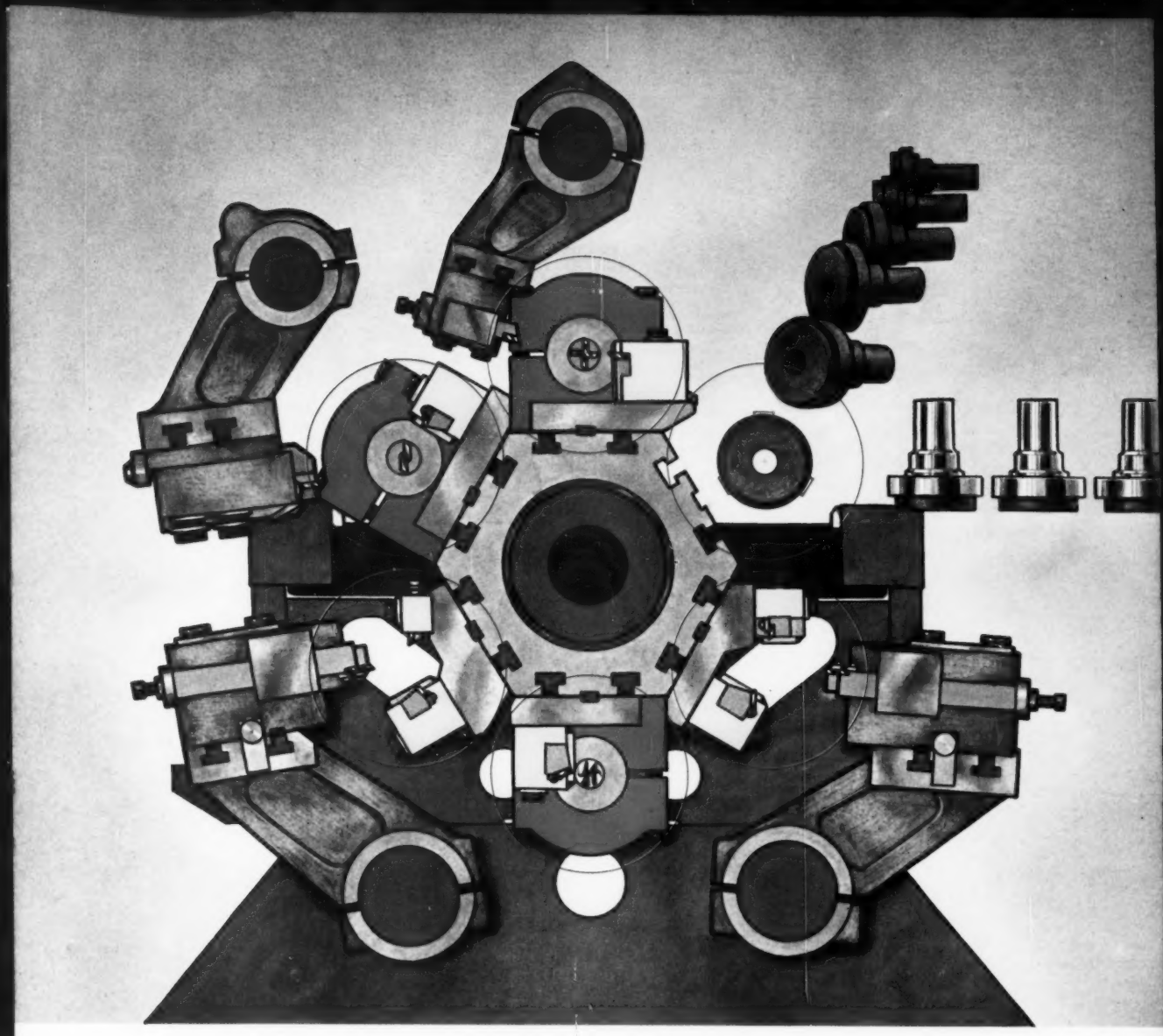
Economists are making startling predictions on this year's increase in productivity. They say it will be twice that of recent years – up as high as 10% in some manufacturing industries.

Whether or not these predictions come to pass, it's certain that it won't happen in plants using outdated equipment.

Shaft work is a problem to many firms. New Britain pioneered template-controlled contour turning and boring, solving the problem for many progressive companies. Now for the manufacturer with really high volume requirements we present Model 412/25–a four-spindle, template-controlled machine capable of producing a four-fold increase in productivity per man hour.

The basic principle pretty much speaks for itself. As in the case of the single-spindle contour lathe, inexpensive metal templates control the full cycle and re-cycle if required. Simple, single-point tools replace complex gang tooling. Set-up is simple and fast. When tools wear, merely replace them. Since all relationships are maintained by the template, tool replacement involves no problem.

When the volume of contour turning warrants it, this machine can be the best money maker on the production floor. Your New Britain representative can quickly tell you after looking at your prints and learning of your production requirements. Meanwhile, we would be glad to mail you descriptive literature containing the basic facts and specifications. New Britain-Gridley Machine Division, The New Britain Machine Company, New Britain, Connecticut.



two *approaches to the depreciation problem*

Until there is relief in the form of a more liberal tax depreciation policy, there's only one way to avoid the pinch of a shop full of over-age machines you can't afford to replace: *Buy machines that will stay new.*

If you are a user of New Britain chuckers you have seen their basic principles continue to stand as the most advanced design available, year in and year out.

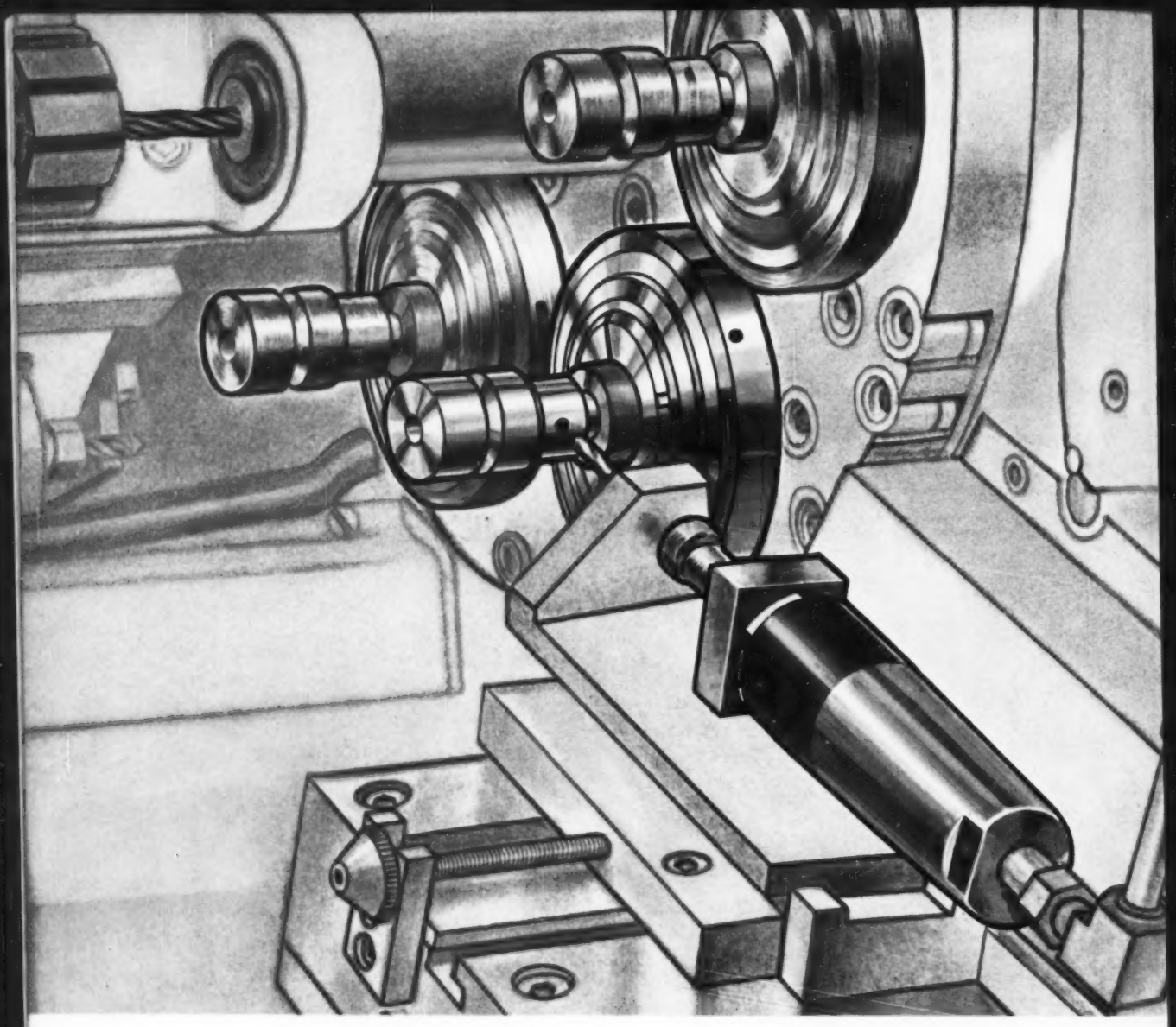
What value do you place on lifetime machine accuracy? The spindle carrier is the heart of a chucking machine. On a New Britain the carrier is lifted during index so it can't wear—then positively clamped to the frame during the cutting cycle for accurate cutting.

Interested in heavy facing and forming cuts? The long established New Britain swinging forming arm feature remains the best answer.

Want maximum clearance for fast and easy tooling, adjustment, and chip removal? Only New Britains are built with open end construction.

Today's New Britain chuckers provide the spindle speeds and power to take advantage of the most modern cutting tools. Optional tooling equipment includes drill speeders and attachments for reversing and non-reversing threading, recessing and accelerated reaming.

A new catalog describes the full New Britain line of 4-, 6- and 8-spindle, open-end, chucking machines. Fully illustrated in color, showing actual jobs, it may well suggest ideas for doing your work. Write for your copy. New Britain-Gridley Machine Division, The New Britain Machine Company, New Britain, Connecticut.



1960 productivity **now**

If you have a voice in the purchase of machine tools you have probably begun to think in terms of what will be on exhibit at next year's Machine Tool Show.

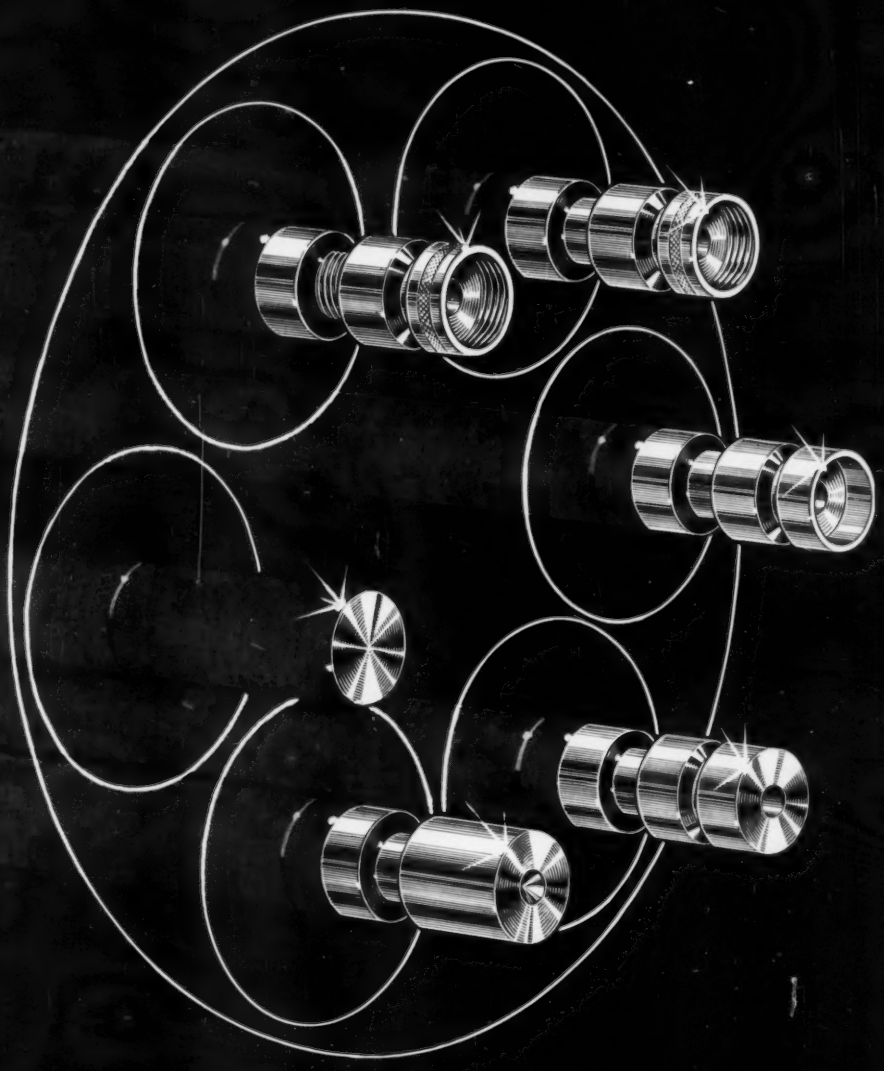
As far as multiple spindle bar work is concerned, you can see and buy and profit from the "show year" developments of New Britains a year ahead of time.

More operations, more pieces per hour, at closer tolerances has been the demand for years. Now New Britain has brought out a complete new line of bar machines that gives these words a brand new meaning.

Take the new Model 45 4-spindle series. The spindle capacity of 5" puts much larger pieces within automatic high-speed bar machine production range. Cross slides in all positions greatly increase the number and variety of cuts possible on four spindles. Spindle speeds up to 526 RPM provide for the use of the latest cutting tools. At the other extreme is a new line of 8-spindle machines. As you would expect with New Britain's radial independent cross slides, you can apply a tremendous number of tools and attachments to get very high production on really complex pieces. Or, with a double indexing set-up, you can turn out pieces, even pretty complex ones, at an all-time high rate per hour.

Six-spindle machines are everybody's work horses and New Britain offers the Model 52 in the 1¼" range, and the Model 62 with 2¼" capacity. These machines allow you to use a greater number and variety of tools on them without sacrificing accessibility. They can be tooled quickly and you can get at the tools for changes or adjustments with ease.

We can only suggest here some of the "show year improvements" in a greatly expanded line of New Britain bar machines. Your New Britain representative will be glad to arrange for a demonstration, and secure performance data based on your prints. If you would like to look over a catalog first, we'll be glad to send you complete descriptive literature. New Britain-Gridley Machine Division, The New Britain Machine Company, New Britain, Conn.



3½"—More **capacity** than ever in a New Britain

Model 82 • Six Spindles • 3½" Capacity • All New

Here is a *brand new* New Britain . . . the most modern large capacity bar machine available. The Model 82 brings to the 3½" size range all the versatility and exclusive New Britain features previously available only on smaller models. Designed from the ground up for large capacity work, the Model 82 is the only 6-spindle machine on the market that offers a really up-to-date replacement for the older, slower methods currently used for this size range.

Each of the six spindles on the Model 82 has an independent, cam-operated cross slide. These cross slides combined with the end-working tool slide allow practically unlimited tooling combinations.

The Model 82, like all New Britain Bar Machines, has a special lifting and locating mechanism which prevents wear on the spindle carrier. Rigid locking of the carrier to the massive frame during the cutting cycle eliminates vibration.

The power, massiveness, speed range, accuracy, ease of changeover, coolant capacity and every other feature designed into the Model 82 makes this the right machine for high-precision, high-production, large-capacity bar work.

Why not investigate the possibilities the Model 82 offers in your plant? When you get right down to it, it's the first chance you've had in a long time to update production in an area that needs it badly. Complete catalog material is available on the whole range of New Britain Six Spindle Bar Machines. For your copy, write to The New Britain Machine Company, New Britain-Gridley Machine Division, New Britain, Conn.

For more data, circle this page number on inquiry card

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a small
hydraulic
press
so productive
it...

Model "A" Denison hydraulic Multipress. Available in 1-ton and 2-ton ram capacity.

Guarantees your savings

If in 45 days the Denison Model "A" Multipress does not cut your production costs or does not improve production quality, simplify operation or give your shop more versatility, simply return the press. You pay only for the freight. FOR ANY JOB ASSEMBLY, FORMING, STAKING...101 MORE

1. High-speed cycle time
2. Easy pressure adjustment
3. Foolproof safety controls
4. Manual or automatic operation
5. Ample 8" daylight for tooling
6. Compact... only 24" high
7. Lightweight... just 225 pounds
8. Smooth, controlled **hydraulic** pressure does all your pressing jobs better and faster
9. Now available in **both** 1-ton and 2-ton capacity

1-ton $395
2-ton $595

Write for a detailed bulletin

DENISON ENGINEERING DIVISION
American Brake Shoe Co.
1152 Dublin Road • Columbus 16, Ohio

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- **LOS ANGELES** 1651 East El Segundo Blvd. Hawthorne, California
- **DETROIT** 900 W. Maple Road Troy, Michigan
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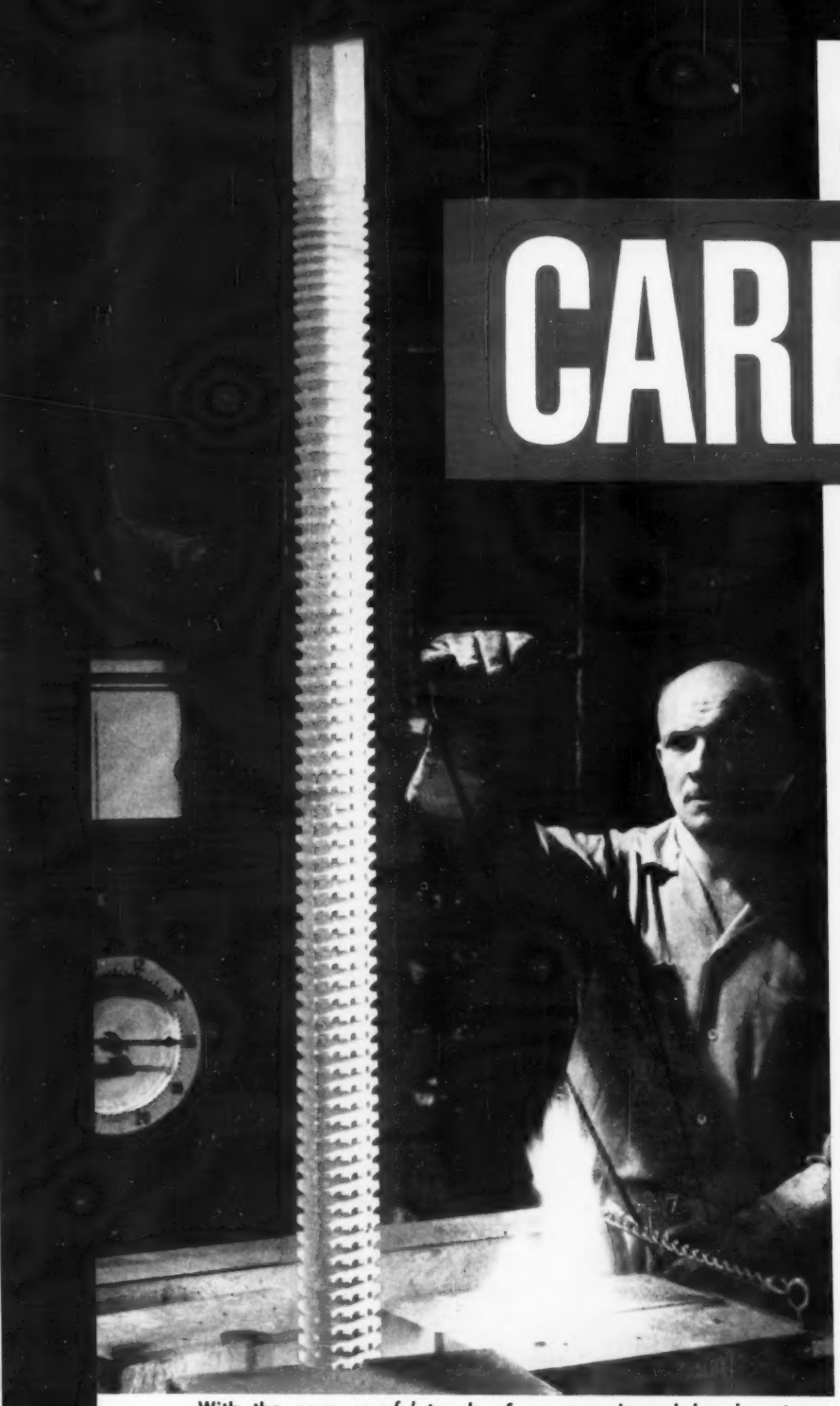
DENISON HydrOILics

HYDRAULIC PRESSES • PUMPS
MOTORS • CONTROLS

CAREFUL!



With the sure, *careful* touch of an experienced hand, veteran CTW heat-treat man hoists 72" broach from a vertical furnace.

Care in the creation of Continental Broaches takes precision manufacturing a step beyond the exactness of quality control. Thirty years of broachmaking—designing and producing thousands of standard and custom-made broaches—assures *unmatched* efficiency and performance from CTW Broaches.

Find out how Continental's experience in broach engineering, modern heat treat methods and cost-saving production processes can cut downtime and increase output in your operation. Call your local Ex-Cell-O representative, or contact Ex-Cell-O Detroit; in Canada, Colonial Tool Co., Ltd., Windsor.

59-14

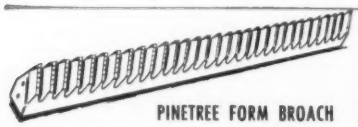
CTW

Continental TOOL WORKS

DIVISION OF

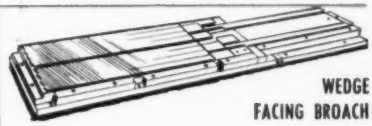
EX-CELL-O CORPORATION

DETROIT 32, MICHIGAN

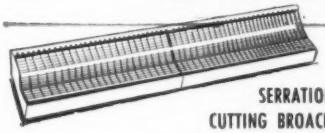


PINETREE FORM BROACH

SPIRAL SPLINE BROACH

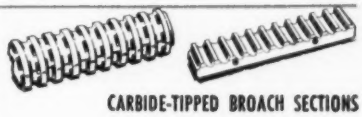


WEDGE FACING BROACH



SERRATION CUTTING BROACH

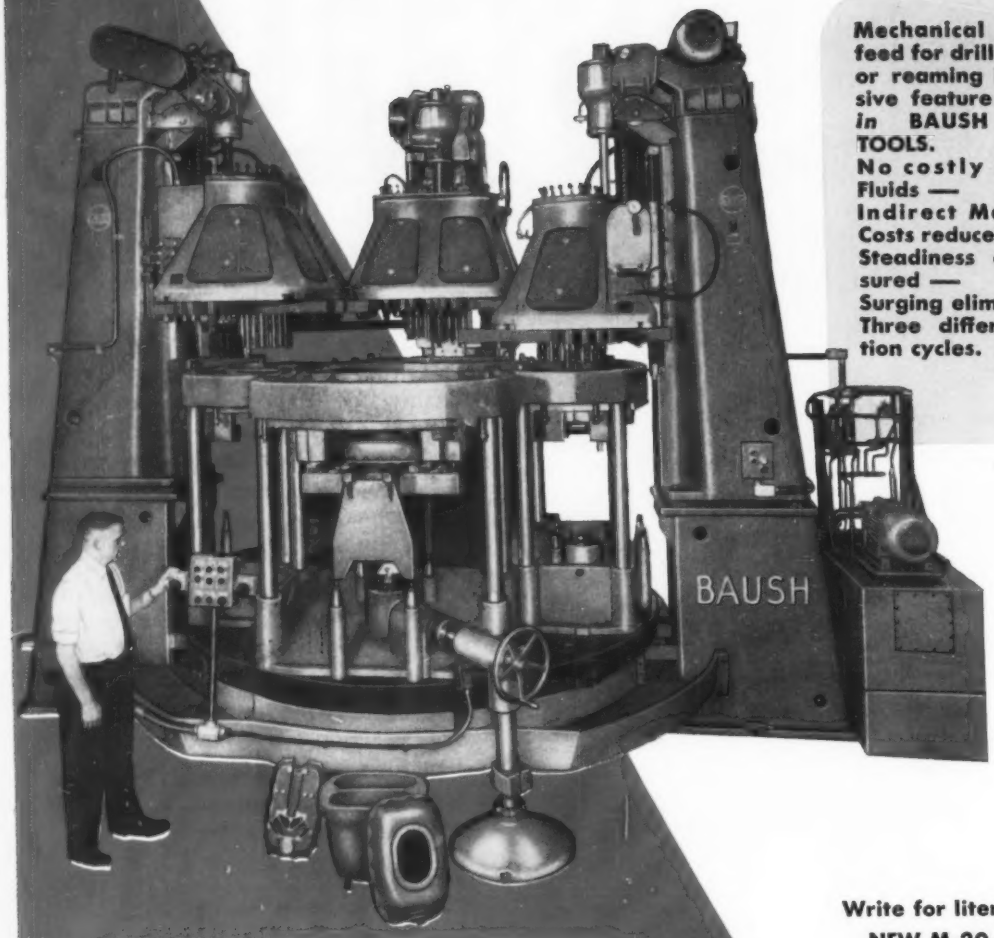
INVOLUTE SPLINE SHELL-TYPE BROACH



CARBIDE-TIPPED BROACH SECTIONS

VERSATILE MECHANICAL LEADSCREW MACHINE

With Master Fixture Holding Units and Mounting Plates, Drills, Taps and Reams 39 Different Parts of Gas Meter Accurately and Economically



Mechanical Leadscrew feed for drilling, tapping or reaming is an exclusive feature *found only in* BAUSH MACHINE TOOLS.
No costly Hydraulic Fluids —
Indirect Maintenance Costs reduced —
Steadiness of feed insured —
Surging eliminated —
Three different production cycles.

SPECIFICATIONS:

Each of three vertical columns mounts an M-20 Mechanical Leadscrew Machine. The 124" diam. Semi-Automatic Hydraulic Rotary Indexing Table has four stations. M-20 Units are mounted at Stations 2 - 3 and 4. Each head is 27" x 40" and is bored for 32 spindles with 32 upper spindle drivers 1½" in diam. arranged for 2 speeds and a neutral position. Both feed and spindle speed are variable . . feed can be varied from .005 per Rev. Low to .090 per Rev. High, and spindle speeds from 130 RPM to 1050 RPM.

Feed is thru ball screw direct from spindle driving gears. When a head goes from rapid traverse to feed stroke an electric brake holds leadscrew and shuts off traverse motor — saving wear and tear. Heads have automatic high production cycle — semi-automatic low production cycle, and a jog cycle for set-up. Machine has 98 spindles and adjustable arms. Operation sequence is:

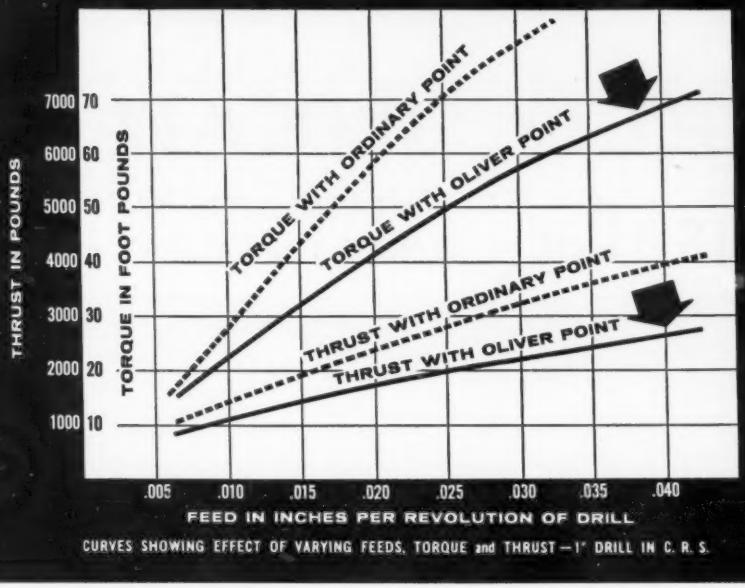
Station 1 — Unload and load
Station 2 — Multiple Drilling
Station 3 — Multiple drilling, chamfering and reaming.
Station 4 — Multiple Tapping (Master Leadscrew Method)

Machine has:

3 — 20 HP 1800 RPM motors for spindle drives
3 — 1 HP 900 RPM motors for Rapid Traverse Heads
1 — 7½ HP 1200 RPM motor operating Rotary Table.

Write for literature on this NEW M-20 MECHANICAL LEADSCREW machine NOW. Send us your problems — our Engineers can help you.

BAUSH
MACHINE TOOL CO.
SPRINGFIELD 7, MASSACHUSETTS



CURVES SHOWING EFFECT OF VARYING FEEDS, TORQUE and THRUST—1" DRILL IN C. R. S.

OLIVER'S UNIQUE DRILL POINTER gives you more holes per grind

Substantially less torque—much less thrust!

The above graph is a typical test run by the research department of an eastern engineering school. It is evidence that Oliver can help you get more and better holes per grind.

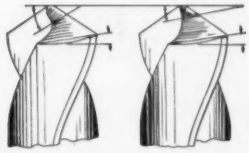
Oliver's sharpening principle is to grind the drill point so that increased clearance is obtained at the center of the drill. Each lip does its equal share and the theoretically perfect point permits easier penetration. Less feeding pressure means savings on drilling machine repairs, power and transmission costs and the drills themselves. *The Oliver point has been successfully used since 1921.*

Oliver drill pointers are rugged enough to stand up to every day pounding. Features of the Model #510 include: a universal chucking head which holds drills from ¼ to 3 inches in diameter and swivels to give varying angles from 82 to 160°; an adjustable cam to give a variable amount of clearance at the cutting edge; and a positive drive to the chuck. In addition, all main shafts—including the grinding wheel spindle—are mounted on anti-friction bearings.

Want proof? Oliver will sharpen *your* drills on a "no-charge" trial basis. Write today for full information. We'd like the opportunity of sending a quotation.

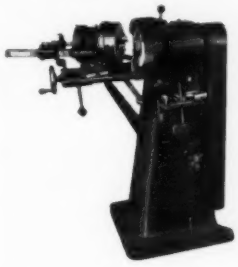
HOW TO REDUCE YOUR TWIST DRILL COSTS

Any substantial reduction in drill costs must be made by choosing a combination of the right drill design *and drill point*. As specialists in the manufacture of tool and cutter grinding machinery we are able to offer drill pointing machines designed expressly for cost reduction.



The sketch above shows a comparison of two drill points. The one on the right is as ordinarily ground. On the left is an exaggerated view of an Oliver drill point. Note that the clearance angle on the point increases very rapidly as the drill web is approached.

It is a widely accepted fact that for a given feed the angle of helix of the feed is greater as it approaches the center. It is this reason that makes increased clearance at the center of the drill point so essential. The Oliver pointers provide average thrust reductions of 25.2% and average torque reductions of 22.0%.



The Oliver 510 makes possible the trouble free grinding of drills—whether 2, 3 or 4 flute. Variable included point angles and clearances are easily obtained.

This cost-saving point is also available by using the new heavy-duty #21 bench model machine. Capacity is 3/32" to ½". A 5" diameter cup wheel and a built-in diamond dresser provides for easy operation regardless of drill size or included angle.

OLIVER of ADRIAN

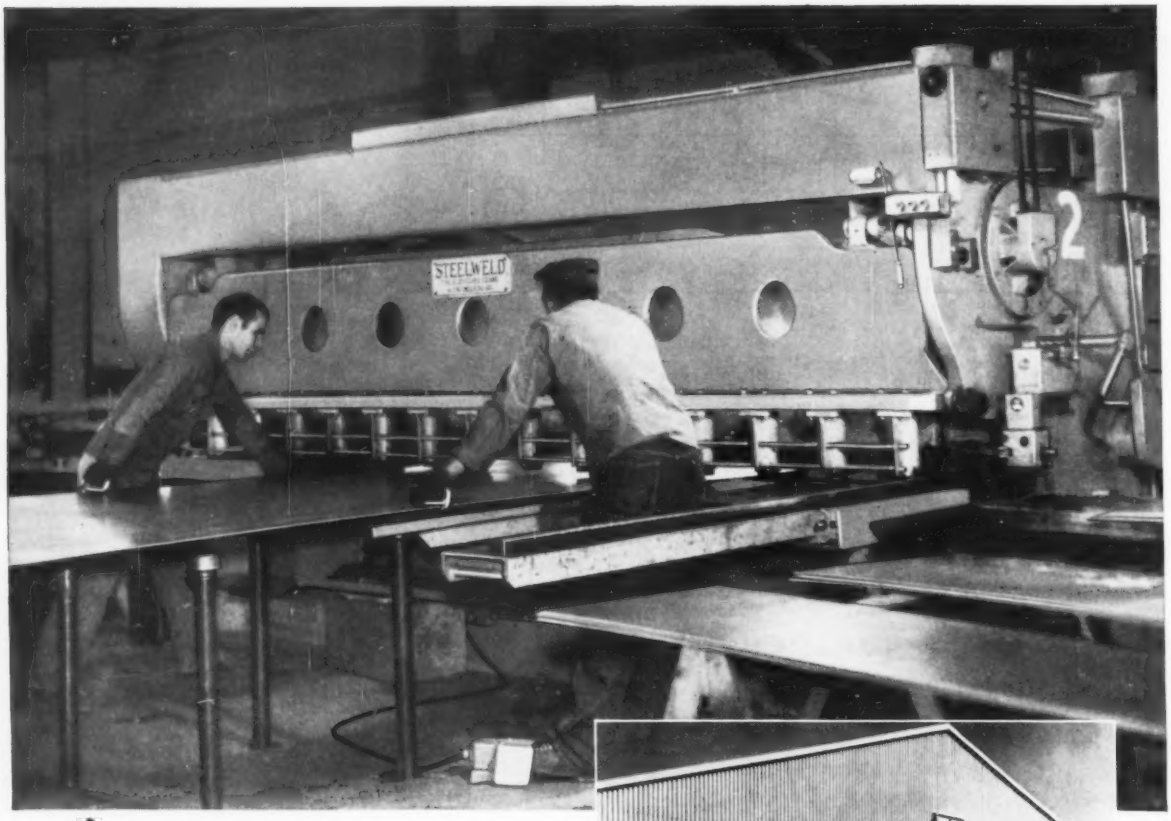
1410 E. Maumee St. • Adrian, Michigan

DRILL GRINDERS AND THINNERS—TOOL AND CUTTER GRINDERS—AUTOMATIC AND MANUAL FACE MILL GRINDERS—TOOL BIT GRINDERS—CONTOUR SAWING AND FILING MACHINES

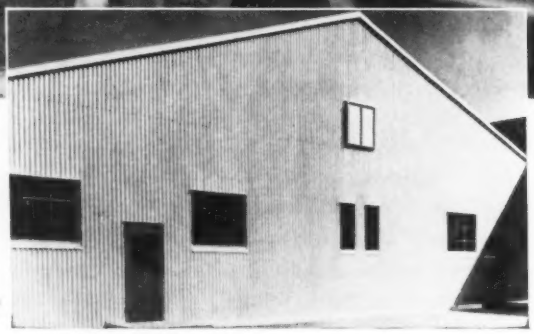
STEELWELD SHEAR

Operates 16 Hours a Day

Cuts Components for Prefabricated Buildings



Cutting and slitting operations normally keep this Steelweld Shear busy 16 hours a day. It is equipped with Steelweld's popular Micro-Set Knife Adjustment. This permits adjusting the knife clearance to suit the thickness of metal being cut in the matter of seconds. Thus, the finest cuts are assured for every shearing job.



A recent Pascoe Building.

RAPIDLY forging ahead in the prefabricated steel building field, Pascoe Steel Corporation, Pomona, California, has found its Steelweld Shear to be an extremely important factor in maintaining a steady rate of production. A large amount of shearing is required to fabricate several hundred tons of steel per month.

The Shear is normally operated 16 hours a day. It is used for cutting web plates for building columns, rafters and many other building components. About 20 hours a week it is used for slitting. The machine has functioned with very little maintenance. In nearly three years of service, the clutch has never required adjustment.

For the very latest in shears and brakes, mechanically or hydraulically operated, be sure to see what Steelweld has to offer.

Write for free copy of catalog No. 2011

STEELWELD

Mechanical and Hydraulic

SHEARS PIVOTED BLADE

Steelweld Machinery includes: Mechanical & Hydraulic Shears and Press Brakes, One-, Two- and Four-Point Straight-Side Presses, Speed-Draw Presses.

THE CLEVELAND CRANE & ENGINEERING COMPANY • 5459 EAST 282nd STREET • WICKLIFFE, OHIO

Questions and Answers about ELCIDE 75

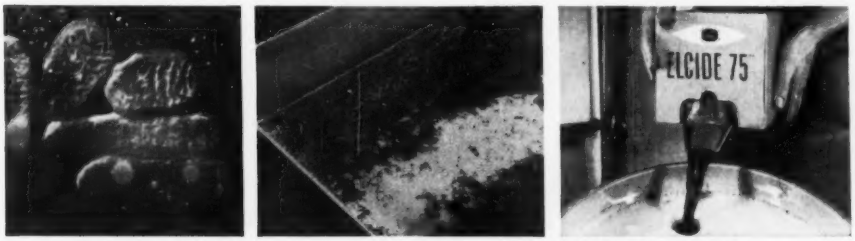
Here's what you'll want to know about this new bacterial inhibitor for soluble oil emulsions:

Q: What is Elcide 75?

A: Elcide 75 is a new bacterial inhibitor for standard duty soluble oil emulsions. Chemically, it is a combination of Sodium Ethylmercuri Thiosalicylate (Thimerosal) and Sodium *o*-phenylphenate in a concentrated solution.

Q: What does Elcide 75 do?

A: Elcide 75 controls bacteria that contaminate soluble oil emulsions. Since both chemical ingredients are anti-bacterial agents, Elcide 75's double action controls a far wider range of bacteria than the commonly used germicides.



Bacteria like these prematurely spoil emulsions. Elcide 75 stops their damage.

Q: Why is bacteria control important?

A: Bacteria enter emulsions through the air, water, and plant debris. They multiply rapidly and cause odor, corrosion, and premature emulsion breakdown. This compounded damage costs millions of dollars each year in higher maintenance and production costs. Bacteria control reduces these expenses.

Q: How does Elcide 75 lower operating costs?

A: The use of Elcide 75 can increase emulsion life as much as 5½ times. You use less soluble oil. Fewer man-hours are spent servicing machines and disposing of waste oil. And, because machines run longer between emulsion changes, production is increased proportionately.

Q: What is the exact dollar return from Elcide 75?

A: No exact figure can be established because conditions vary between plants. The type of metal, machines, and operations involved, the coolant, and general plant housekeeping are all factors that help determine savings due to Elcide 75. The best way to measure its value is to try Elcide 75 and compare the results with untreated machines under your plant conditions.

Q: How is Elcide 75 used?

A: One ounce of Elcide 75 is added to each four gallons of emulsion. You know you have a safe, effective treatment because you control the dosage.

Q: Is Elcide 75 safe to employees?

A: Yes. It also eliminates objectionable odors and certain bacteria that may cause skin infections.

Q: Will Elcide 75 harm machinery or products?

A: No. In fact, Elcide 75 controls bacteria that often cause acidic corrosion and shortened tool life.

Q: Is more information available on Elcide 75?

A: Yes. Complete data on compatibility, disposal, stability, safety, and other pertinent factors are available on written request.

Q: Where can I buy Elcide 75?

A: Elcide 75 is sold only through selected distributors. To place your order, or for the name of your nearest distributor, write Eli Lilly and Company, Agricultural and Industrial Products Division, Indianapolis 6, Indiana; or telephone MElrose 6-2211.

ELCIDE 75™

PATENT PENDING

KEEPS COOLANTS FRESH AS A DAISY!

Package	Price per Gal.
1-gal. (4 per case), polyethylene	$8.50
5-gallon, polyethylene	$8.00
55-gallon, stainless steel	$6.50

(Lilly's brand of bacterial inhibitor for cutting fluids)

ELI Lilly AND COMPANY • AGRICULTURAL AND INDUSTRIAL PRODUCTS DIVISION • INDIANAPOLIS 6, INDIANA

For more data, circle this page number on inquiry card

UNIVERSAL JIG AND FIXTURE COMPONENTS AND CLAMP ASSEMBLIES

Shown here are a few of more than a thousand different items in regular steel and stainless steel —the largest and most complete selection in the United States—now available from Universal Engineering Co. Write today for your copy of the complete, new catalog.

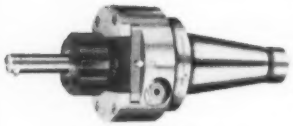
213

OTHER PRECISION-BUILT COST SAVING UNIVERSAL PRODUCTION TOOLS

Floating Chuck

Standard Collet Chuck

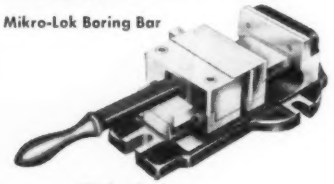
Mikro-Lok Boring Bar



Boring Chuck

"Kwik-Switch" Tool Holder

Standard Drill Bushing



Wedge-Lock Production Vise

UNIVERSAL ENGINEERING COMPANY, FRANKENMUTH 2, MICHIGAN

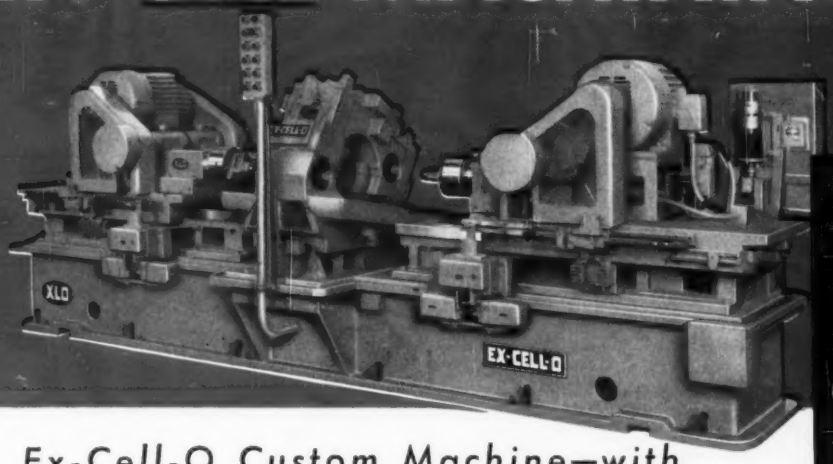
FROM ROUGH...

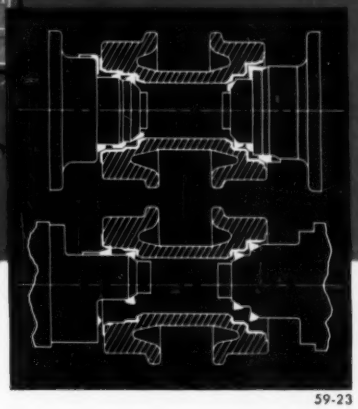
Heavy boring and plunge-facing

TO FINISH

Precision boring and facing

IN ONE MACHINING CYCLE





59-23

Ex-Cell-O Custom Machine—with quick-change tooling—speeds output of large, cast-iron track rollers

This Ex-Cell-O Custom Machine features precision—in a big way.

A track roller for rugged, off-the-road equipment, is clamped in the hydraulically-actuated fixture; the rest—from rough to finish—is automatic.

The part is first rough-bored on both ends at the same time. Then both slides retract and the fixture indexes into position for finish boring and facing at both ends, simultaneously. (Drawing, above-right, shows rough and finish tooling.) Slides again retract and the fixture is unclamped, ready for the next cycle. Easily changed tooling heads and clamping jaws permit precision machining of any of three similar components with minimum lag in production.

See your Ex-Cell-O Representative, or write direct for full details on Ex-Cell-O Custom Machines—specially designed with extended capacity for changing production needs.

EX-CELL-O FOR PRECISION XLO

EX-CELL-O CORPORATION
DETROIT 32, MICHIGAN

Machinery Division

EX-CELL-O PRECISION PRODUCTS INCLUDE: MACHINE TOOLS • GRINDING AND BORING SPINDLES • CUTTING TOOLS • RAILROAD PINS AND BUSHINGS • DRILL JIG BUSHINGS • TORQUE ACTUATORS • THREAD AND GROOVE GAGES • GRANITE SURFACE PLATES • AIRCRAFT AND MISCELLANEOUS PRODUCTION PARTS • DAIRY EQUIPMENT

ARMSTRONG

Drop Forged CLAMPS

LEADERS IN THE DROP FORGED CLAMP FIELD

. . . in design, machining and strength; in completeness of line in both sizes and types.

Designs are based on a full knowledge of clamp uses and requisites. Drop forging assures die-perfect form, texture toughness and freedom from structural faults. Maximum stiffness is attained by a discerning selection of steels with accurate controlled heat-treating, tempering and testing.

For dependability and long useful life, specify and standardize on ARMSTRONG Drop Forged Clamps.

EXTRA DEEP THROAT "C" CLAMPS

Provide extra clearance required for some work. Extremely stiff for weight. Screws and hubs are accurately machined and aligned with machined seats; have sliding pin handles and free-acting swivel caps on point. Bodies have smooth sandblast finish.
(8 sizes to 12" opening)

Write for new ARMSTRONG General Catalog showing almost 5000 industrial tools.

ARMSTRONG BROS. TOOL CO.
5213 W. ARMSTRONG AVE. • CHICAGO 46, U.S.A.

HEAVY DUTY "C" CLAMPS

Universally recognized as strongest "C" clamps made. Longer hub holds screw alignment against terrific side strain; permit tighter clamping and multiples thread friction against loosening. Extra large screws are heat treated and hardened at point.
(11 sizes to 12¾" opening)

MEDIUM SERVICE "C" CLAMPS

The design and careful selection of steels in this type clamp combine to give it maximum strength and stiffness consistent with convenient weight. Heat treated screw with sliding pin handle and swivel cap on point. Ground seat.
(9 sizes to 18" opening)

TOOL MAKERS "C" CLAMPS

Quality steels, drop forged, heat treated and accurately machined with ground seats. Drop forged screws have both "wing nut" handle for convenience and square necks for tight setting with a wrench. Either "plain" or "swivel" screw types.
(Four sizes: 1", 2", 3" or 4" maximum opening)

SPATTER RESISTANT WELDERS "C" CLAMPS

Extra Deep Throat Pattern (see above). Body, Swivel and Screw are cadmium plated over all to resist welding spatter.
(8 sizes Capacities to 12" opening)

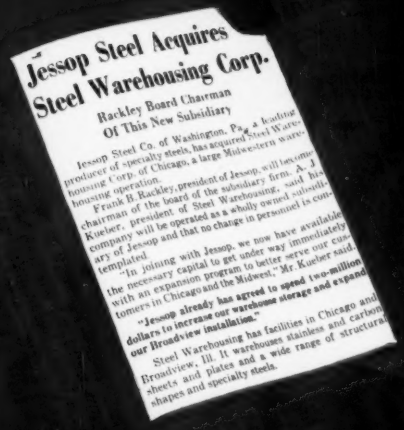
MACHINISTS' CLAMPS

Jaws drop forged, carefully machined and hardened, are extra heavy; will not bend or spring on a short bite and are faced true. Will grip non-parallel surfaces because the under face of the center screw is convex, fitting into a concave seat for tilting.
(Four sizes: Capacities to 4¼" opening)

PARALLEL CLAMPS

Carefully machined from selected grade steel and hardened. Particularly suited for holding work together when drilling or tapping. Rounded jaw ends increase clearance in close quarters. Spring clip holds loose pin in alignment while tightening or loosening.
(3 sizes: Capacities to 2½" opening).

(Not Drop Forged)


Jessop Steel Acquires
Steel Warehousing Corp.
Rackley Board Chairman
Of This New Subsidiary
Jessop Steel Co. of Washington, Pa., a leading
producer of specialty steels, has acquired Steel Ware-
housing Corp. of Chicago, a large Mid-western ware-
Frank B. Rackley, president of Jessop, will become
chairman of the board of the subsidiary firm. A. J.
Kueber, president of Steel Warehousing, said his
company will be operated as a wholly owned subsidi-
ary of Jessop and that no change in personnel is con-
templated.
"In joining with Jessop, we now have available
the necessary capital to get under way immediately
with an expansion program to better serve our cus-
tomers in Chicago and the Midwest," Mr. Kueber said.
"Jessop already has agreed to spend two-million
dollars to increase our warehouse storage and expand
our Broadview installation."
Steel Warehousing has facilities in Chicago and
Broadview, Ill. It warehouses stainless and carbon
sheets and plates and a wide range of structural
shapes and specialty steels.

Jessop buys Steel Warehousing Corporation . . . another reason for your confidence!

When you specify Jessop specialty steels, you've got good reasons for that decision. For example . . .

With Jessop, you're dealing with success. Although it's only two years since the acquisition of Green River Steel, Jessop now adds Steel Warehousing of Chicago. Already a two million dollar expansion of warehousing facilities is underway.

This fast growth didn't just happen. It results from the Jessop policy of producing the highest quality specialty steels *and keeping delivery promises!*

Yes, you have good reasons to be confident when you specify Jessop.

VMA 6721

JESSOP
STEEL COMPANY
Washington, Pennsylvania

Subsidiary Companies:

Green River Steel Corporation, Owensboro, Kentucky
Jessop Steel of Canada, Ltd., Wallaceburg, Ontario
Jessop Steel International Corporation, New York City
Steel Warehousing Corporation, Chicago and Broadview, Ill.

Stainless, alloy, tool, cast-to-shape, and forging steels, precision ground flat stock, and other specialty steels

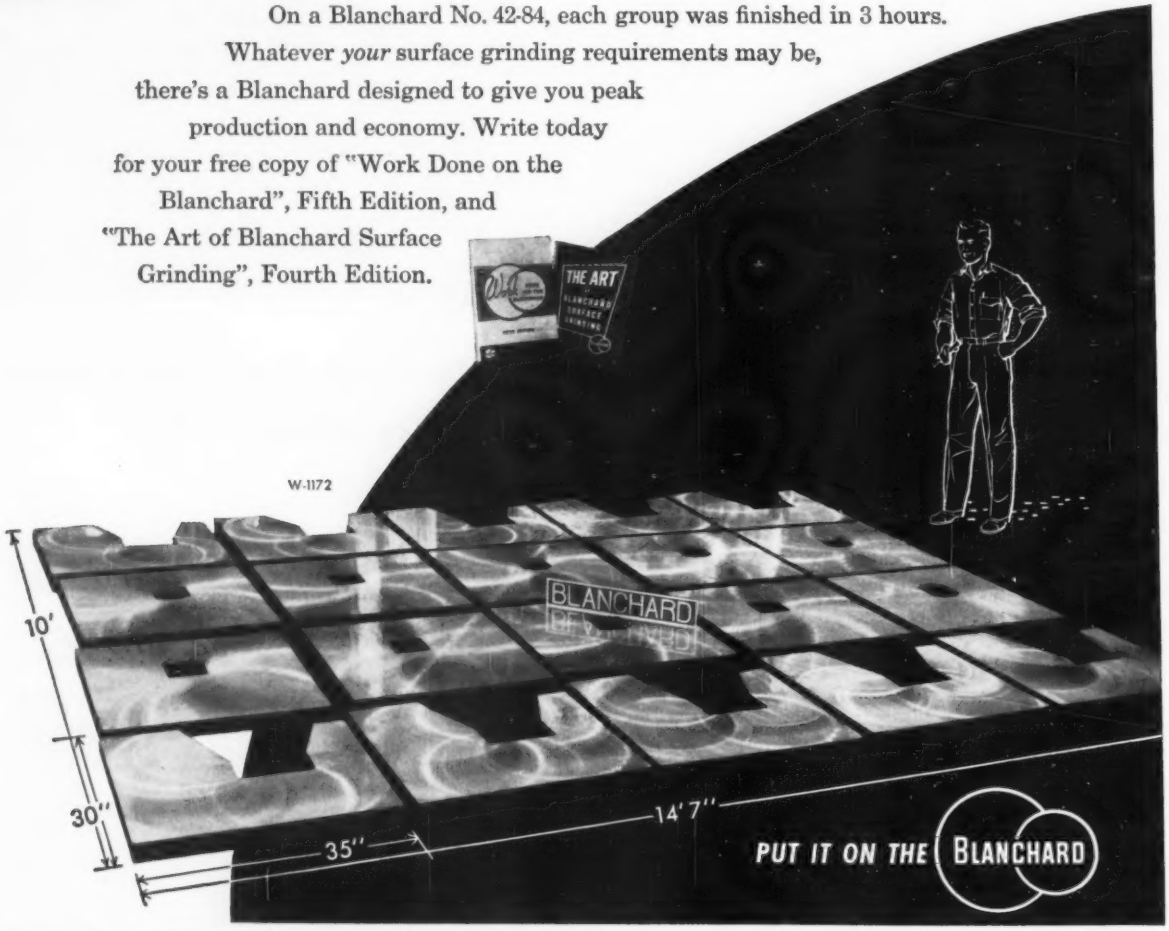
For more data, circle this page number on inquiry card

Grinding Perfection is Assured When You "Put it on the Blanchard"

V-517

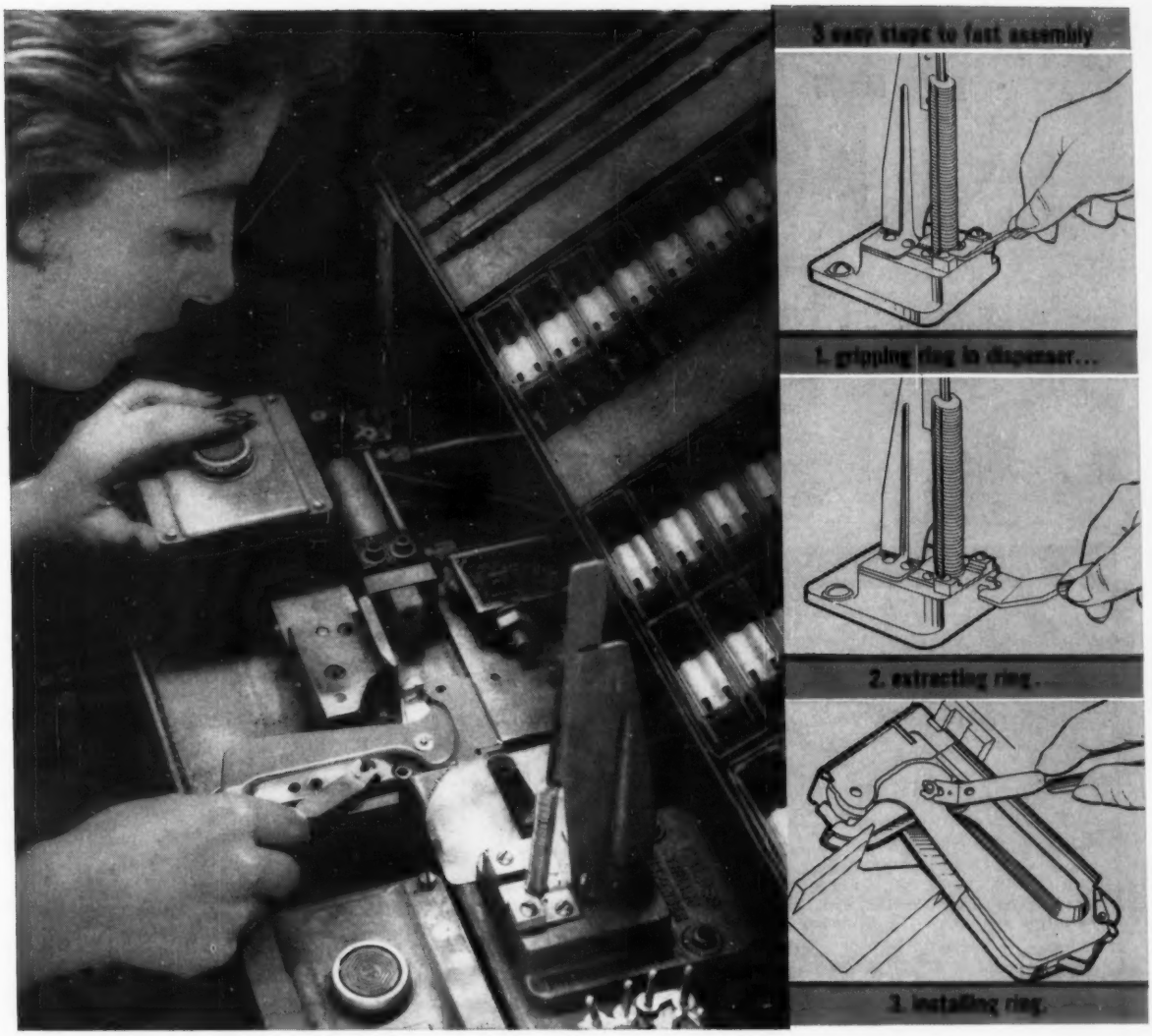
The production speed and precision of modern Blanchard Surface Grinders are illustrated by this interesting job, involving 20 plates measuring 30″ x 35″ x 3″. Ten of them had openings of 6½″ x 4″, the other ten had openings of 11″ x 20″. Each group of plates required stock removal of 5/32″ from two sides, with flatness of .003″. On a Blanchard No. 42-84, each group was finished in 3 hours.

Whatever *your* surface grinding requirements may be, there's a Blanchard designed to give you peak production and economy. Write today for your free copy of "Work Done on the Blanchard", Fifth Edition, and "The Art of Blanchard Surface Grinding", Fourth Edition.



W-1172

THE BLANCHARD MACHINE COMPANY 64 STATE ST., CAMBRIDGE 39, MASS., U. S. A.



Truarc rings and dispenser speed staple gun assembly 60%

This big production increase was made by Swingline, Inc., Long Island City, N. Y. in assembling the handle lock of their high-compression staple gun.

To speed production, the Truarc Prong-Lock® Series 5139 retaining rings come *pre-stacked* for use on the Truarc *dispenser* (shown in foreground of photo above). Application is simple, fast and requires no skill. The operator, using the Truarc *applicator*, grasps the bottom ring, removes it from the stack, and installs it, quickly and easily, in the staple gun assembly.

The Truarc ring replaced an ordinary flat "C" washer, previously used in this application. *While the unit cost of the washer was lower than that of the Truarc retaining ring, the use of the rings resulted in assembled cost savings of $25.00 per thousand staple guns.* The reasons: a 60% increase in production due to faster, easier assembly with Truarc tools, and the elimination of time-consuming, costly adjustments made possible by Truarc rings. What's more, the bowed Prong-Lock ring improved product design by providing resilient end-play take-up ... eliminating looseness or binding in the parts.

Truarc retaining rings come in 50 functionally different types ... as many as 97 different sizes within a type ... 6 metal specifications and 13 finishes. Truarc assembly tools, pliers, applicators, dispensers and grooving tools are available to speed production of virtually every kind of product. Make sure you have on file the new 16-page Waldes Truarc Assembly Tool Catalog No. AT 10-58. Write for your copy today. And remember Waldes engineers are always ready to help you solve your special application problems. Waldes Kohinoor Inc., 47-16 Austel Place, Long Island City 1, N. Y.

©1959 WALDES KOHINOOR, INC. 9.2

WALDES TRUARC® RETAINING RINGS

Waldes Kohinoor Inc., Long Island City 1, N. Y.

TRUARC RETAINING RINGS ... THE ENGINEERED FASTENING METHOD FOR REDUCING MATERIAL, MACHINING AND ASSEMBLY COSTS

NICE

...for Good Reasons

- NICE offers complete lines of precision, semi-precision and unground standard bearings.
- NICE offers facilities and "know-how" to design and produce "specials" to exactly suit individual bearing application requirements.
- NICE standard and special bearings offer Product Designers many design improvement and cost-saving opportunities.
- NICE Bearings have proved their economic and performance value in the accepted products of many hundreds of well-known manufacturers.

CATALOG STANDARD BEARINGS

Typical "1600" Series Low Cost Precision Radial Bearings and "3000" Series Unground "Precision Type" Radials, Metal Shielded or Open, or with Composition Seals, Inch Sizes. Also "C" Series Precision Radial Bearings Metal Shielded or Open in established Light Duty Inch Standard Sizes. All Solid Inner and Outer Race Type with Retainer, as illustrated.

Another Typical Nice Catalog Standard, Inexpensive "500" Series Unground Radial and Thrust Bearings, Full Ball Type, Pressed Cone, Soft Outer Band, Inch Sizes.

Catalog Standard "600" Series "Steering Knuckle" type Self-contained Unground Thrust Bearings, Full Ball Type, Soft Outer Band, Inch Sizes.

SPECIAL BEARINGS

No. 7235-H Forage Harvester Cam Follower is typical of NICE experience and ingenuity as "Specialists in Specials". This relatively inexpensive one-piece assembly replaces a precision bearing with separate bolt and separate outer tire. A unique, but simple seal design* effectively retains lubricant and excludes dust, dirt and moisture under the difficult conditions of operation typical of farm implement service. No. 7235-H is also an example of the well applied use of the UNIBAL principle of construction.

The New UNIBAL® Ball Bearing

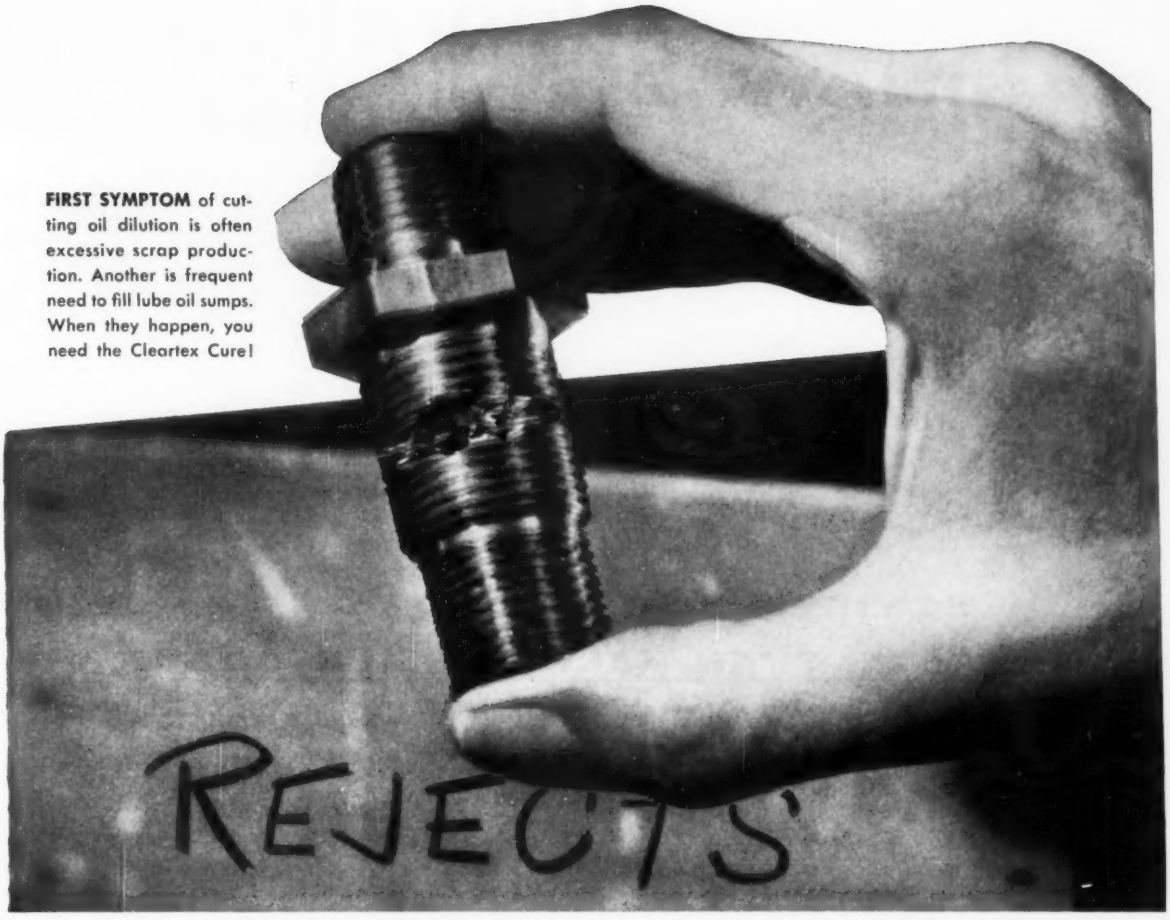
NICE now offers the revolutionary new UNIBAL, a low cost bearing of superior quality, suitable for many precision bearing applications. UNIBAL construction* features solid inner and outer raceways, with deep, unbroken ball grooves and a full complement of balls. Unique new manufacturing methods produce bearings of exceptional durability and strength.

Your Inquiries Invited.

NICE®

*Patent Applied For

NICE BALL BEARING COMPANY
NICETOWN · PHILADELPHIA · PENNSYLVANIA
DIVISION OF CHANNING CORPORATION



FIRST SYMPTOM of cutting oil dilution is often excessive scrap production. Another is frequent need to fill lube oil sumps. When they happen, you need the Cleartex Cure!

Diluted cutting oil can pile up rejects

When you find your scrap production soaring, the villain may be lube oil leaking into the cutting oil sumps of your automatic screw machines. It happens in 7 out of 10 automatics in spite of the most careful lubricating techniques. This dilution will lower cutting oil effectiveness—and, as it loses its efficiency, rejects pile up, tool life drops, and production can go down by as much as 33 per cent!

Texaco Cleartex can solve the problem—forever!
Because of its exceptional stability and load-carrying ability, Cleartex can function *both* as a cutting oil *and* as a lubricant —and even as a hydraulic fluid. When *all* your automatics' sumps are filled with Cleartex, unavoidable leakage is no longer a problem. Excessive scrap production will stop, tools will last longer and production will go up.

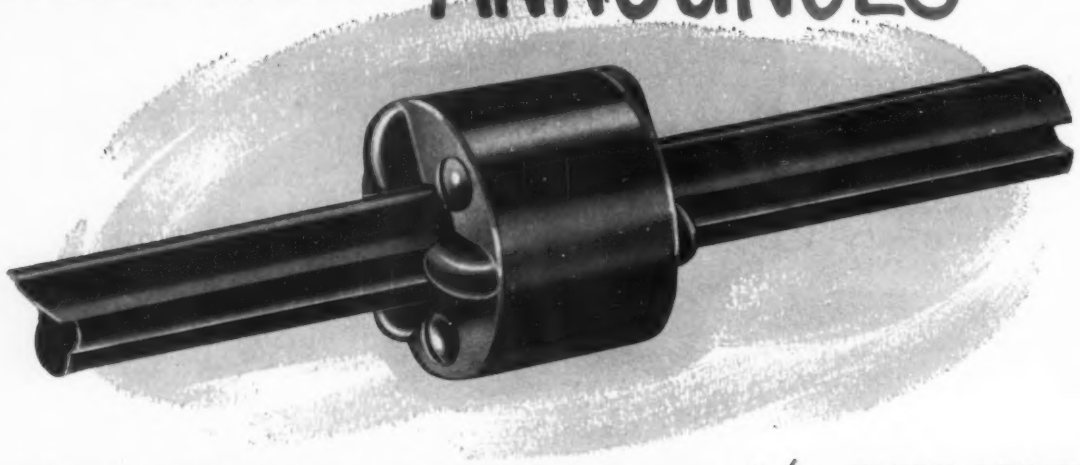
TAKE THE "CLEARTEX CURE" SOON!
Write today for your copy of Texaco's new booklet—"Cleartex in Automatic Screw Machines." This new illustrated guide will fill you in on the details, show you where you may be losing profits and how to avoid it. Or contact your local Texaco Lubrication Engineer for an authoritative survey of your automatics. Just call the nearest of the more than 2,000 Texaco Distributing Plants, or write:

Texaco Inc., 135 East 42nd Street, New York 17, N. Y., Dept. MA-31.

LUBRICATION IS A MAJOR FACTOR IN COST CONTROL
(PARTS, INVENTORY, PRODUCTION, DOWNTIME, MAINTENANCE)

For more data, circle this page number on inquiry card

SAGINAW ANNOUNCES



A NEW SERIES OF STANDARD b/b SPLINES

AT LESS THAN HALF FORMER COST!

Average 40 TIMES Lower Coefficient of Friction than Conventional Sliding Splines— Far Better Performance at Comparable Cost

Good news for machine tool, aircraft and other designers! Standardization and volume production economies now enable you to take full advantage of this revolutionary ball/bearing Spline, built on the same gliding ball principle pioneered by the famous Saginaw b/b Screw.

Wherever easy linear movement is required under high torque load, Saginaw Standard b/b Splines offer:

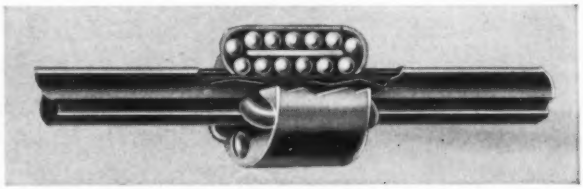
- ***Freedom from Frictional Heat***
- ***Minimum Radial Lash***
- ***Long, Trouble-free Service Life***

HIGH PRECISION COMMERCIAL QUALITY

These new low-cost Standard b/b Splines are high commercial quality with excellent precision and service life, suitable for all but the most critical applications. Yet they cost about the same as high-friction splines.

TRANSMIT OR RESTRAIN HIGH TORQUE LOADS NO OTHER SPLINE CAN HANDLE

Standard b/b Splines are so friction-free that they permit previously impossible applications under very heavy torque loads, where the effort required to slide conventional splines would exceed the structural strength of members. They literally let you achieve the "impossible"!



Saginaw b/b Splines transmit or restrain high torque loads with far less friction because mating surfaces *glide* on rolling balls instead of *sliding* back and forth. Steel balls recirculate in closed circuits formed by mating longitudinal raceways spaced around the circumference of inner and outer parts.

6 STANDARD SIZES

.375 .625 1.000 1.500 2.000 2.500

Can be fitted with integral gears, clutch dogs, bearing and sprocket seats or other attachments for use with electrical, hydraulic or pneumatic units.

SEND TODAY FOR FREE BALL BEARING SCREW AND SPLINE HANDBOOK
or see our section in Sweet's Product Design file.

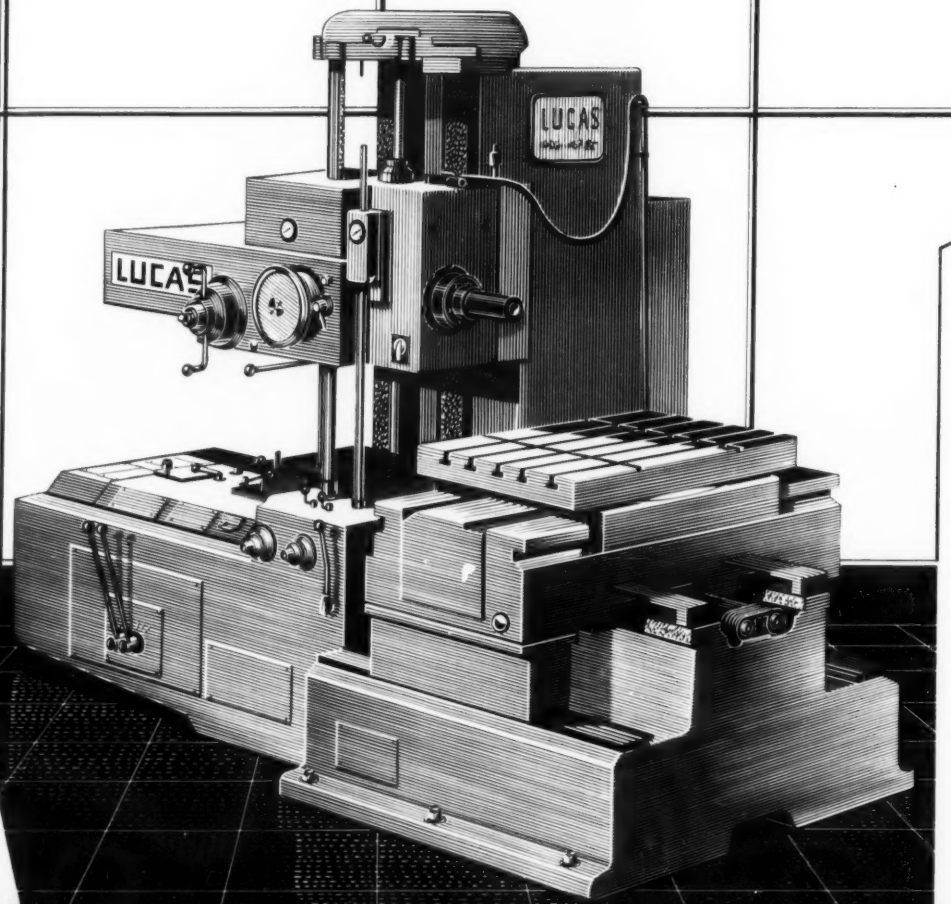
Saginaw ball/bearing Screws & Splines

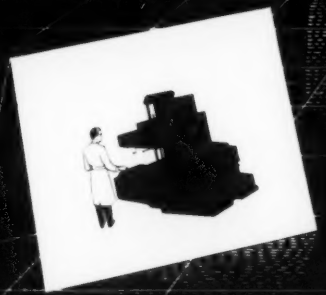
SAGINAW STEERING GEAR DIVISION OF GENERAL MOTORS CORPORATION, SAGINAW, MICHIGAN

WORLD'S LARGEST PRODUCER OF BALL/BEARING SCREWS AND SPLINES

newest and smallest in a distinguished line

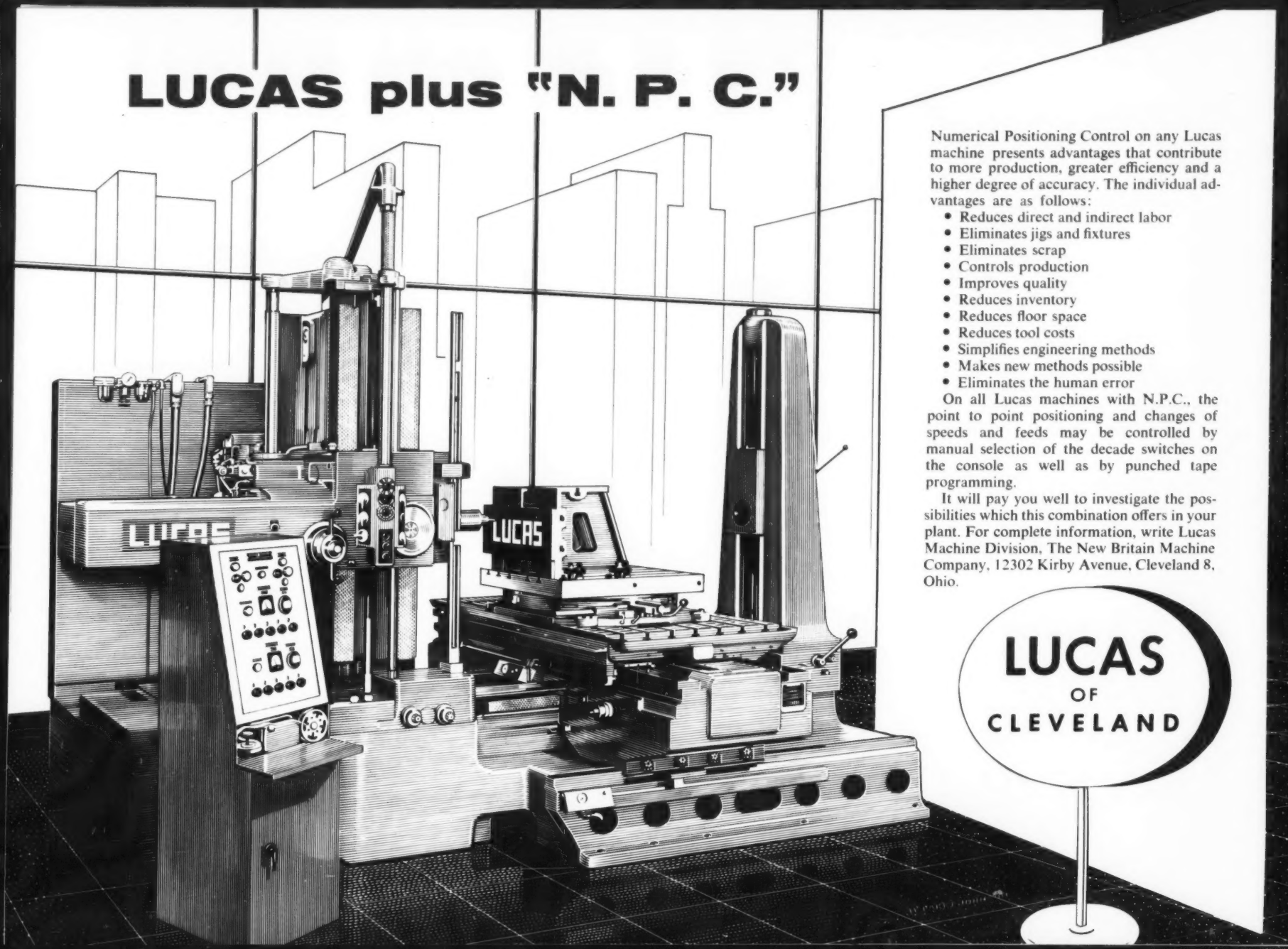
LUCAS OF CLEVELAND





The new Lucas Horizontal Boring, Milling and Drilling Machine offers all the quality construction features of the other fine precision machines in the Lucas line plus a built-in Rotary Table. This versatile little machine is made-to-order for production of small dies, fixtures, miniature electronic parts, machine casings, aircraft and missile parts and similar work. The inherent accuracy of the Lucas 275-40-RT suits it for a variety of post-production inspection operations. Air Lift to saddle and table. Constant-operating automatic lubrication. Spindle diameter 2.750″ or 3.000″. Spindle travel 18″. Vertical Head travel 24″. Cross travel 30″. Longitudinal Saddle travel 18″. Table 26″ x 30″. Spindle speeds 62-2000 rpm. Feeds from .0007″-.915″. Tape programming can be added as an optional feature. For complete information, write Lucas Machine Division, The New Britain Machine Company, 12302 Kirby Avenue, Cleveland 8, Ohio.

LUCAS plus "N. P. C."



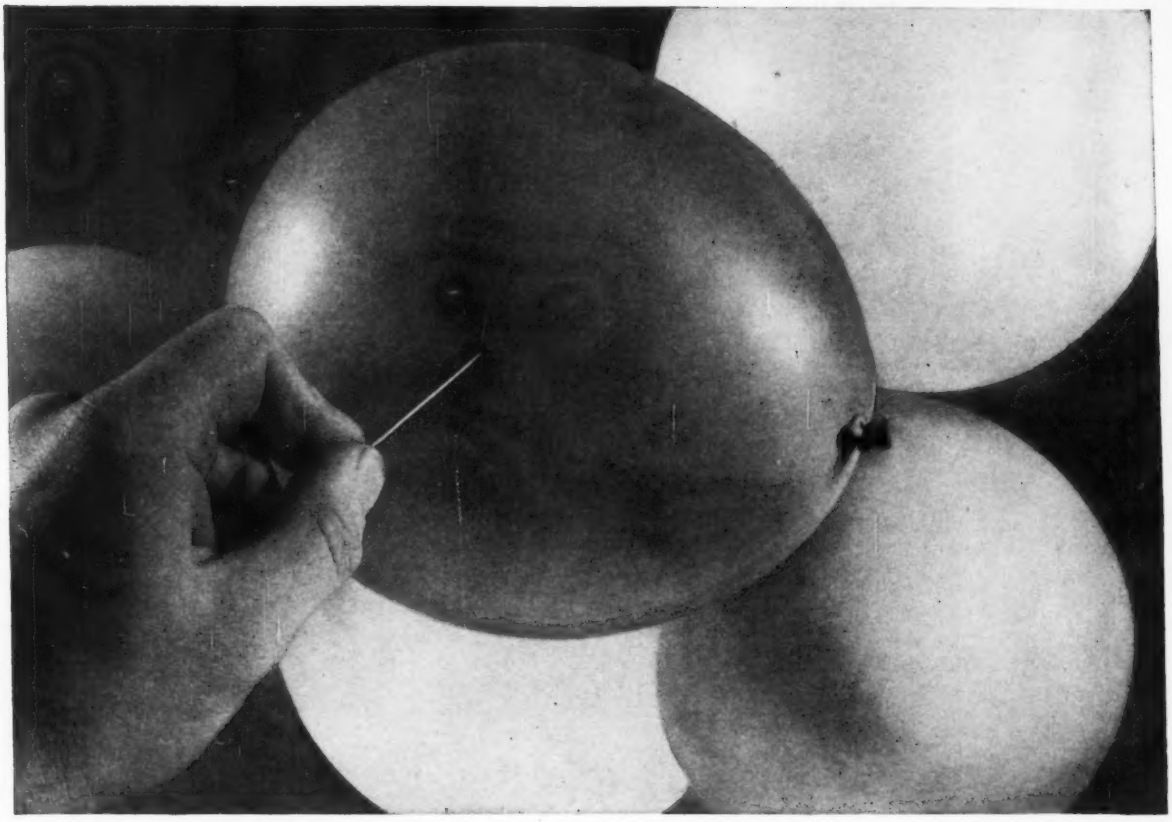
Numerical Positioning Control on any Lucas machine presents advantages that contribute to more production, greater efficiency and a higher degree of accuracy. The individual advantages are as follows:

- Reduces direct and indirect labor
- Eliminates jigs and fixtures
- Eliminates scrap
- Controls production
- Improves quality
- Reduces inventory
- Reduces floor space
- Reduces tool costs
- Simplifies engineering methods
- Makes new methods possible
- Eliminates the human error

On all Lucas machines with N.P.C., the point to point positioning and changes of speeds and feeds may be controlled by manual selection of the decade switches on the console as well as by punched tape programming.

It will pay you well to investigate the possibilities which this combination offers in your plant. For complete information, write Lucas Machine Division, The New Britain Machine Company, 12302 Kirby Avenue, Cleveland 8, Ohio.

LUCAS
OF
CLEVELAND



Machine Tool Buyers:

Beware the fallacy of projecting today's labor rates!

Almost without exception, machine tool replacement formulas employ an erroneous factor in computing savings — they are based on *today's* labor rates.

It seems basically sound to suggest, in the case of a contemplated investment in equipment, that a projection be made as to the estimated period over which the equipment is to be used.

Assuming this to be ten years, it is a fairly simple matter to project the *average* wage rate over the next ten years by using the historical increase for the past several years. This increase is known to be from 5 to 6% per year.

Using 5%, we then have a simple computation to determine the average projected wage rate which should be used in computing savings in a replacement formula.

Assuming a current wage rate of $2.50 per hour, this becomes $4.07 per hour at the end of ten years, or an increase of 62.8% over today's labor rate.

This percentage increase could reasonably be applied also to other factors in the computation of savings, such as indirect labor, fringe benefits, maintenance, etc.

In contemplating the purchase of a piece of equipment which will last for a number of years, it is fallacious, therefore, to compute savings in terms of today's costs only.

Does Jones & Lamson offer a positive approach; a realistic, workable formula that is free from fallacies such as this? *Yes!*

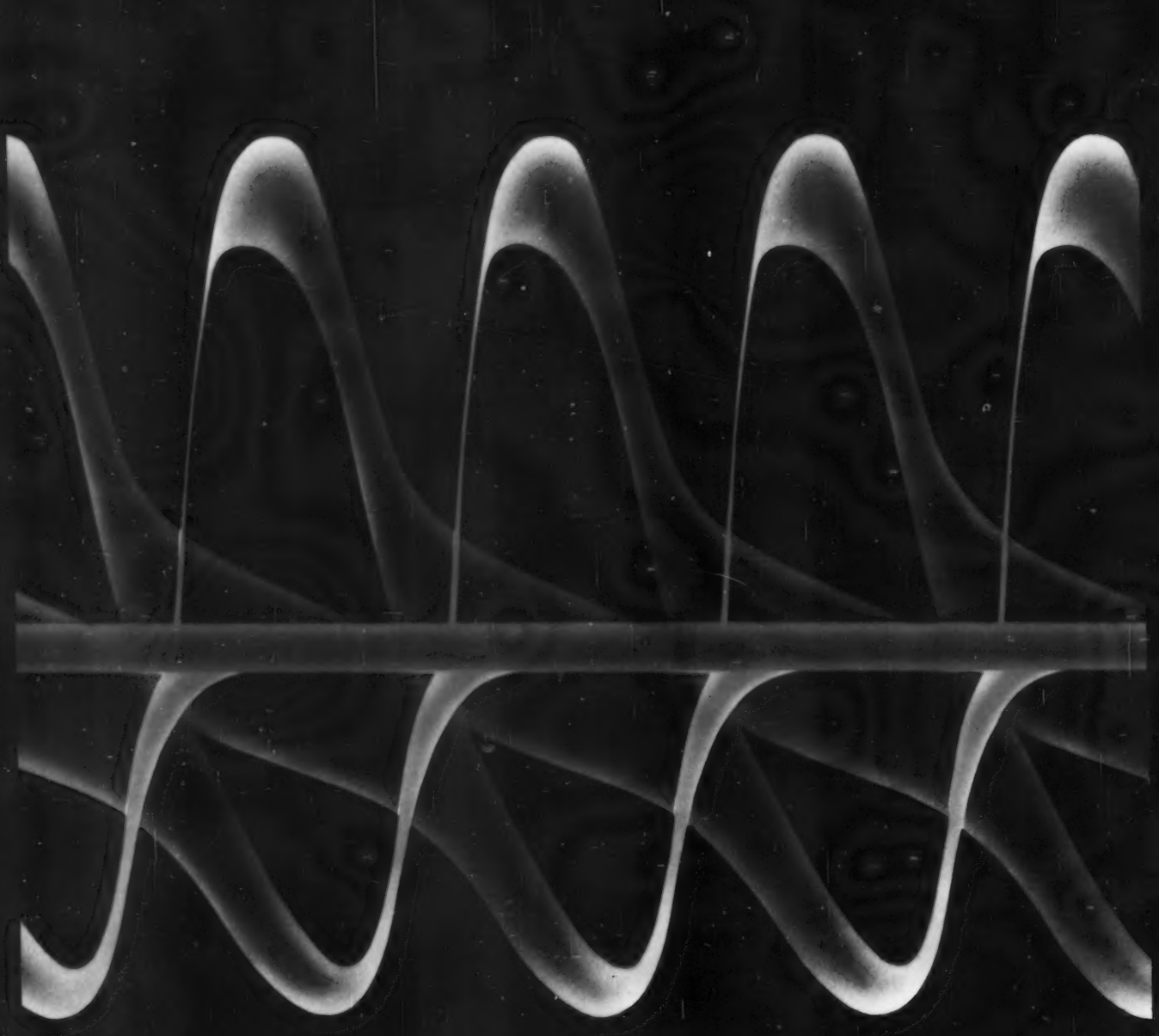
Write today for complete information.

the man who needs
a new machine tool
is already paying for it

JONES & LAMSON Machine Company, 512 Clinton St., Springfield, Vt.

Turret Lathes • Automatic Lathes • Tape Controlled Machines • Thread & Form Grinders • Optical Comparators • Thread Tools

For more data, circle this page number on inquiry card



The cathode ray oscilloscope is one of science's and industry's most perceptive instruments for determining uniformity of operation. The pattern reproduced here is a harmonically modulated sine wave of exact uniformity.

Uniformity is Malleable

Just as the input of an oscilloscope can be controlled to produce repetitive patterns, so can consistently uniform metal parts be produced with Malleable iron because of modern, scientific controls. The unique method by which all Malleable castings are made and the exacting techniques employed by Malleable foundries assure Malleable users of castings that are uniform, part after part, regardless of size or shape. This uniformity, combined with unparalleled physical and mechanical properties, ideally suits Malleable castings for modern America's quality products.

For information or service, call on one of the progressive firms that identify themselves with this symbol—

MEMBER

MALLEABLE

CASTINGS COUNCIL

If you wish, you may inquire direct to the Malleable Castings Council, Union Commerce Building, Cleveland 14, Ohio, for information.

Better Products at Lower Cost Result From Malleable Uniformity Controls

Uniform quality — whether for five or five million pieces — is essential to maintain product quality and increase manufacturing efficiency. With accelerating frequency, Malleable castings contribute their unique uniformity in critical applications where durable, reliable components are necessary.

Key to Uniformity is Control

Malleable iron is produced under closely controlled manufacturing techniques. From charge composition and molding sand properties, through final inspection, every critical factor is held constant by using the most modern techniques of metal analysis, process control and inspection.

Internal Uniformity

This versatile engineering material is achieved through converting the base white iron into tough Malleable iron by a controlled heat treating process. Malleable's internal structure exhibits excellent uniformity, an important factor in assuring the dependable performance of intricately designed components.

External Uniformity

Fundamental to the casting process is the ability to produce a given shape, time after time, in either small or large quantities. Metal can be placed exactly where it is needed . . . eliminated where it is not. Good design — achieved through close cooperation between the customer and the foundry — can assure the necessary tolerances and the lowest possible finished part cost. Modern techniques of production and inspection are used to insure top quality, dimensionally accurate castings.

The life of every motorist rides in complete safety on Malleable wheel hubs of unerring uniformity.

Uniformity Proven by Use

The final test of any part is how well it stands up in actual service. Under continuous cyclic and shock loading, the millions of Malleable wheel hubs, which are in service on the front end of every American-made car, have compiled an enviable record of proven uniformity. Another dramatic example of Malleable's uniformity is proved in the old adage "A chain is only as strong as its weakest link." Miles of Malleable chain, carrying tremendous loads year after year without failure, demonstrate the uniformity of every cast link.

New techniques for controlling every element of Malleable production are the result of intensive research done by Malleable foundries in their continuing search for ways to make Malleable even more versatile and indispensable to industry.

More Information Available

Your copy of *Data Unit 103—Uniformity* — is available from any member of the Malleable Castings Council. If you prefer, write direct to Malleable Castings Council, Union Commerce Building, Cleveland 14, Ohio.

These companies are members of the

MALLEABLE CASTINGS COUNCIL

CONNECTICUT
Connecticut Mall. Castings Co., New Haven 6
Eastern Malleable Iron Co., Naugatuck
New Haven Malleable Iron Co., New Haven 4

DELAWARE
Eastern Malleable Iron Co., Wilmington 99

ILLINOIS
Central Fdry. Div., Gen. Motors, Danville
Chicago Malleable Castings Co., Chicago 43
Moline Malleable Iron Co., St. Charles
National Mall. and Steel Castings Co., Cicero 50
Peoria Malleable Castings Co., Peoria 1
Wagner Castings Company, Decatur

INDIANA
Link-Belt Company, Indianapolis 6
Muncie Malleable Foundry Co., Muncie
Terre Haute Mall. & Mfg. Corp., Terre Haute

MASSACHUSETTS
Belcher Malleable Iron Co., Easton

MICHIGAN
Albion Malleable Iron Co., Albion
Auto Specialties Mfg. Co., Saint Joseph
Cadillac Malleable Iron Co., Cadillac
Central Fdry. Div., Gen. Motors, Saginaw

MINNESOTA
Northern Malleable Iron Co., St. Paul 6

NEW HAMPSHIRE
Laconia Malleable Iron Co., Laconia

NEW JERSEY
Meeker Foundry Company, Newark 4

NEW YORK
Acme Steel & Mall. Iron Works, Buffalo 7
Frazer & Jones Company Division Eastern Malleable Iron Co., Solvay
Oriskany Malleable Iron Co., Inc., Oriskany
Westmoreland Mall. Iron Co., Westmoreland

OHIO
American Malleable Castings Co., Marion
Canton Malleable Iron Co., Canton 5
Central Fdry. Div., Gen. Motors, Defiance
Dayton Mall. Iron Co., Ironton Div., Ironton
Dayton Mall. Iron Co., Ohio Mall. Div., Columbus 16
Maumee Malleable Castings Co., Toledo 5
National Mall. and Steel Castings Co., Cleveland 6

PENNSYLVANIA
Buck Iron Company, Inc., Philadelphia 22
Erie Malleable Iron Co., Erie
Lancaster Malleable Castings Co., Lancaster
Lehigh Foundries Company, Easton
Meadville Malleable Iron Co., Meadville
Pennsylvania Malleable Iron Corp., Lancaster

TEXAS
Texas Foundries, Inc., Lufkin

WEST VIRGINIA
West Virginia Mall. Iron Co., Point Pleasant

WISCONSIN
Badger Malleable & Mfg. Co., S. Milwaukee
Belle City Malleable Iron Co., Racine
Chain Belt Company, Milwaukee 1
Federal Malleable Company, West Allis 14
Kirsh Foundry Inc., Beaver Dam
Lakeside Malleable Castings Co., Racine
Milwaukee Malleable & Grey Iron Works, Milwaukee 46

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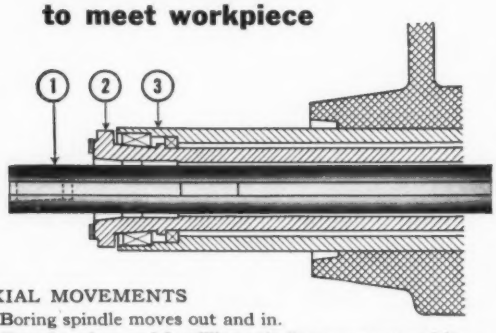
Perform Heavy Milling & Boring With ONE Set-up *on a* FRORIEP

FRORIEP Horizontal Milling & Boring Machine FBT 160/260.

Milling Spindle in Carrying and Sliding Sleeve can be extended to meet workpiece



AXIAL MOVEMENTS

1. Boring spindle moves out and in.
2. Carrying sleeve with milling spindle moves out and in.
3. Carrying sleeve with milling spindle and boring spindle moves together out and in.

FRORIEP FBT Horizontal Boring and Milling Machines Provide—

Heavy duty milling and boring of large workpieces at considerable distance from headstock without loss of accuracy.

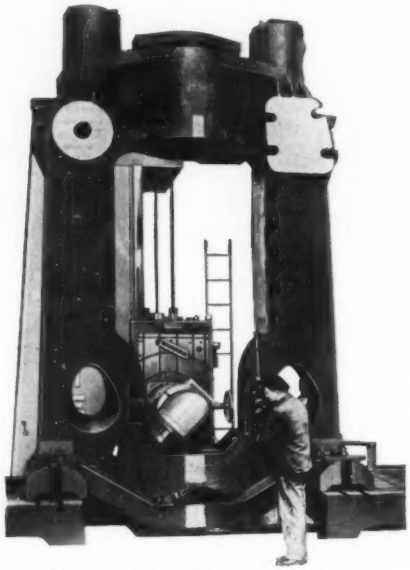
Boring and milling spindles, rotating together—guided and supported by carrying sleeve. This sleeve supports milling spindle immediately behind cutting tool—allows operation at full power with spindle extended.

Powerful drive—wide range of speeds and feeds. Rigidly constructed bed and column permits machining with carbide tools at full working load.

Centralized, remote controls on movable pendant. Operator stands near cutting tools to control all machine movements. Speeds and feeds, pre-selected in in./min. or in./rpm, are set on dials. Automatic electro-hydraulic clamping of all sliding members. Feeding motions for column, headstock and spindles are lever controlled.

A wide variety of operations with one setting. Angular milling heads, radial facing heads and other special tools can be mounted on carrying and sliding sleeve and are easily adjusted into working positions.

Spindle & Sleeve Diameters: Boring—5⅛″ to 8⅞″; Milling—7⅞″ to 15″; Carrying Sleeve—13″ to 26″.

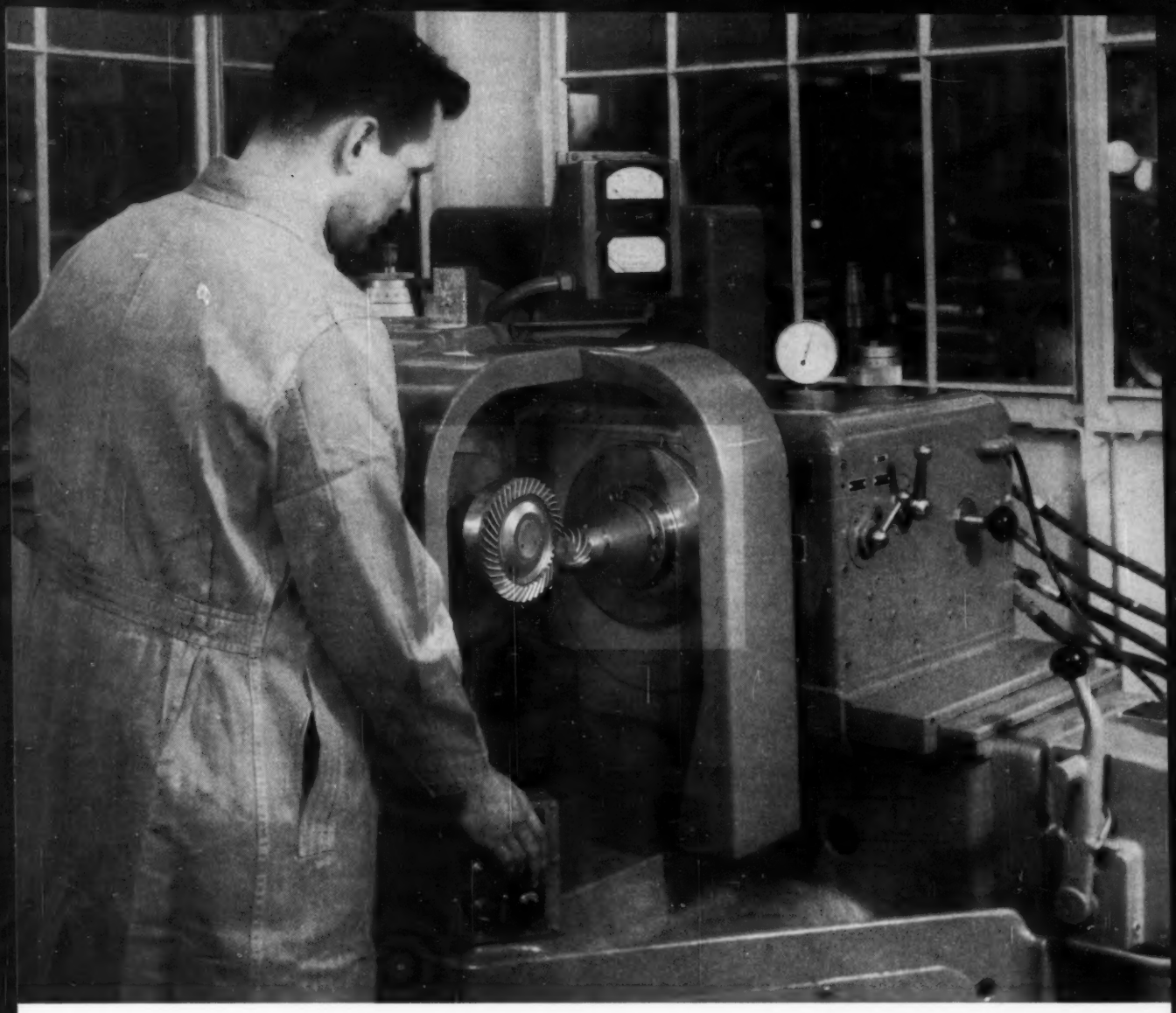


FRORIEP FBT machining a roller frame by means of an angular milling head.

Write for the FRORIEP Horizontal Milling and Boring Machine Catalog

COSA — *nationwide sales and service of precision machine tools —from bench lathes to boring mills.*

COSA CORPORATION, 405 LEXINGTON AVENUE, NEW YORK 17, N.Y.



Now you can *speed-test* gears up to 4000 RPM

Since the accuracy of any gear test depends on how well it simulates actual operating conditions, we've developed a hypoid tester with speeds up to 4000 RPM. The higher range of speed on the No. 17A-4000 Hypoid Tester makes possible a new standard in the testing of bevel gears.

Complete testing on one machine. The No. 17A-4000 Hypoid Tester is arranged for both power and slow rolling tests. With the power test you can observe a gear's smoothness of operation, its noise characteristics, and its tooth contact pattern.

Roll test the gear and you get accurate readings of its eccentricity, tooth size, spacing, and profile.

With the No. 17A-4000 Tester you can test any right angle straight bevel, Zerol® bevel, spiral bevel and hypoid gear of any pitch and up to 20″ OD.

Pre-set backlash control. The No. 17A-4000 Tester has a new hydraulic backlash control mechanism. The control automatically duplicates your pre-set backlash value when you change the relative positions of a gear pair to simulate actual operation.

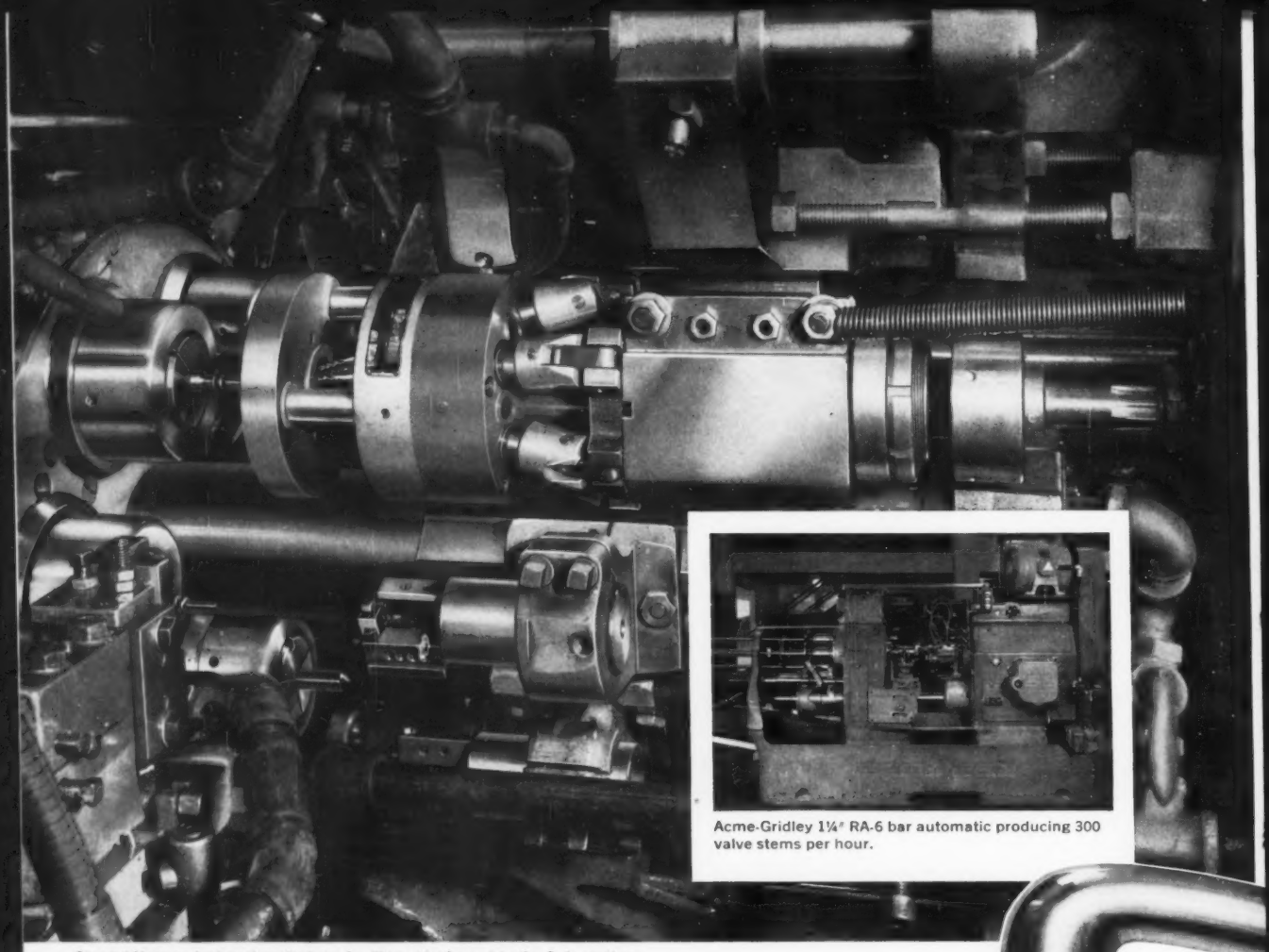
Exact duplication of settings. Indicator set-up fixtures are available for large quantity testing. With these gages you can make identical settings on a battery of machines, or get the same setting repeatedly on a single machine.

New bulletin. We've prepared a bulletin on the No. 17A-4000 Hypoid Tester to answer any questions you might have about its construction or operation. Write for a copy.

GLEASON WORKS

1000 UNIVERISTY AVE., ROCHESTER 3, N. Y.

For more data, circle this page number on inquiry card



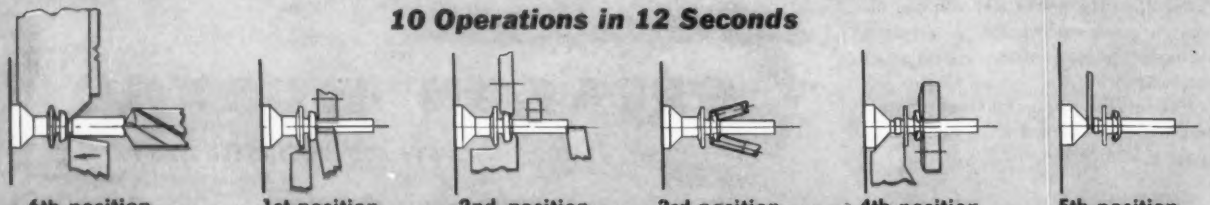
Special Namco-designed multiple end milling attachment in the 3rd position.

Acme-Gridley 1¼" RA-6 bar automatic producing 300 valve stems per hour.

When Tolerances and Finish
Looked Economically Impossible

AMERICAN-STANDARD TURNS TO ACME-GRIDLEY...

10 Operations in 12 Seconds



6th position
Rough form rear —rough turn stem —spot drill

1st position
Finish turn stem face large diameter

2nd position
Shave—face and chamfer stem end

3rd position
Stop spindle— mill six slots

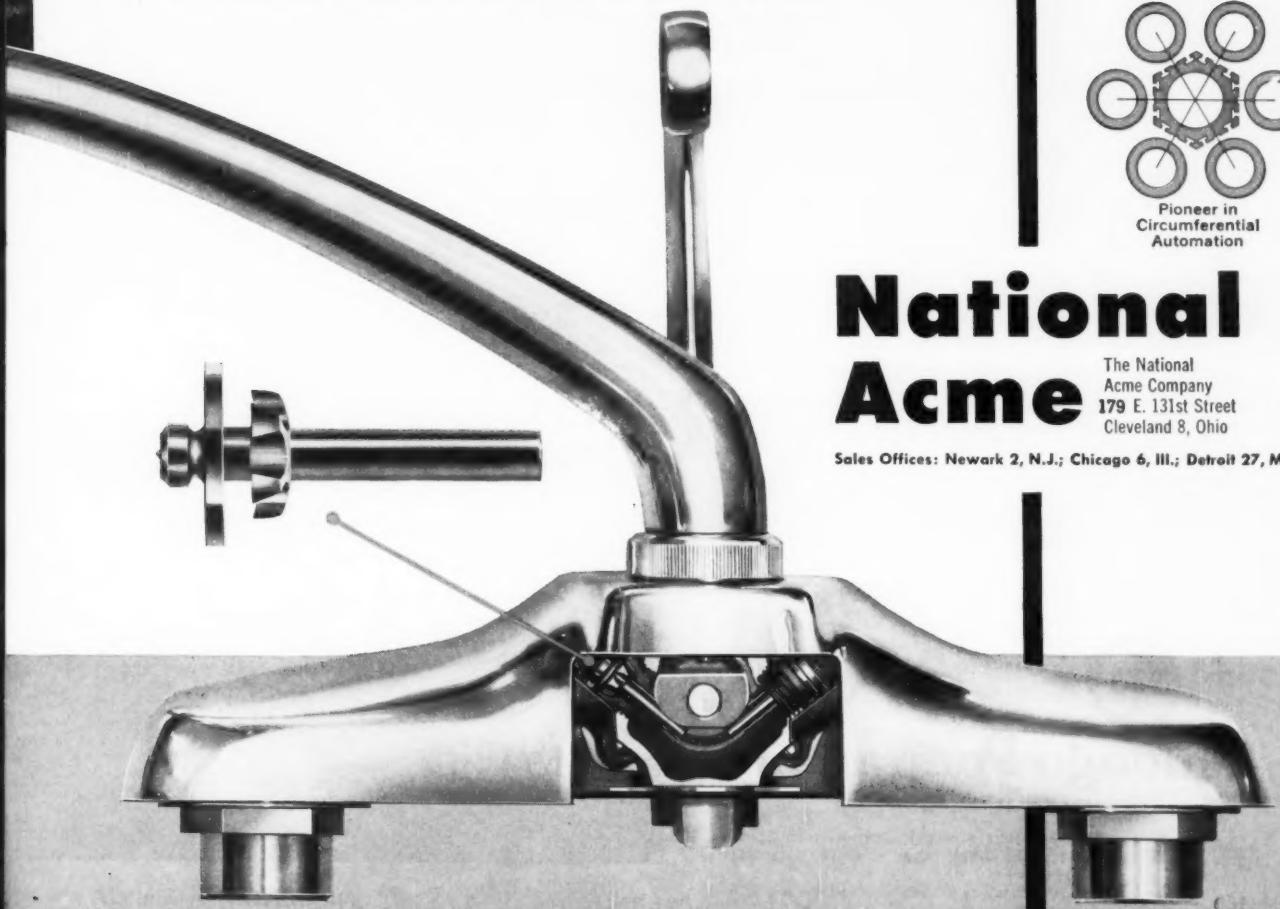
4th position
Start spindle— burnish stem— form back end

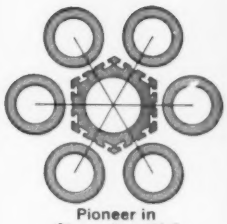
5th position
Cutoff

COMPLETED IN A SINGLE SETUP . . . this hyseal valve stem is a vital component in American-Standard's single-lever mixing faucet. Production by other processes would have meant a two-piece assembly. It would have been economically impossible to meet the high standard of quality and exacting tolerances maintained on this company's products.

Ten operations, including multiple end milling of six half-holes on a 15° angle, were performed on this 303 stainless steel piece in 12 seconds. Rigid specifications required a 20 microinch finish and limits of .002 t.i.r. between seating surface and end of valve stem.

Advanced spindle stopping design and the inherently accurate indexing of Acme-Gridleys, assure proper alignment of the work with the standard and special tool attachments. This, together with wide open tooling zones and independently operated tool slides, helps assure the solution of "impossible" jobs at National Acme. Write or ask one of our representatives for the complete story on the industry's most modern approach to your cost reduction problems.





Pioneer in Circumferential Automation

National Acme

The National Acme Company
179 E. 131st Street
Cleveland 8, Ohio

Sales Offices: Newark 2, N.J.; Chicago 6, Ill.; Detroit 27, Mich.

NEW CP PORTABLE BROACH GUN CONVERTS ROUND PILOT HOLES TO

square

hex

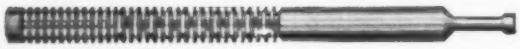
oval

splined

keyed

SHAPES

You take the tool to the work with the CP Portable Broach Gun . . . a completely new technique in broaching. Operation is fast and simple. Broach is inserted in pilot hole and with a squeeze of the trigger the hole is formed or finished in a single, swift operation. Set-up time is eliminated since no jigs, fixtures or templates are required in most applications. Drilled, punched or cast holes can be finished to round, square, hexagon, oval, or irregular shapes in any work area. Angle Broach Puller, for close quarters, is also available.



The broach pulls a clean hole every time, and leaves it "mirror" finished. Hole sizing accuracy can be ±.0002. Unskilled operators can consistently produce accurate holes with minimum training time.

CP Power Cell weighs only 58 pounds, operates on shop air lines, furnishes oil pressure up to 7,000 psi. Easily moved from job to job anywhere in the plant. Also powers hydraulic riveters, squeezers, punches.

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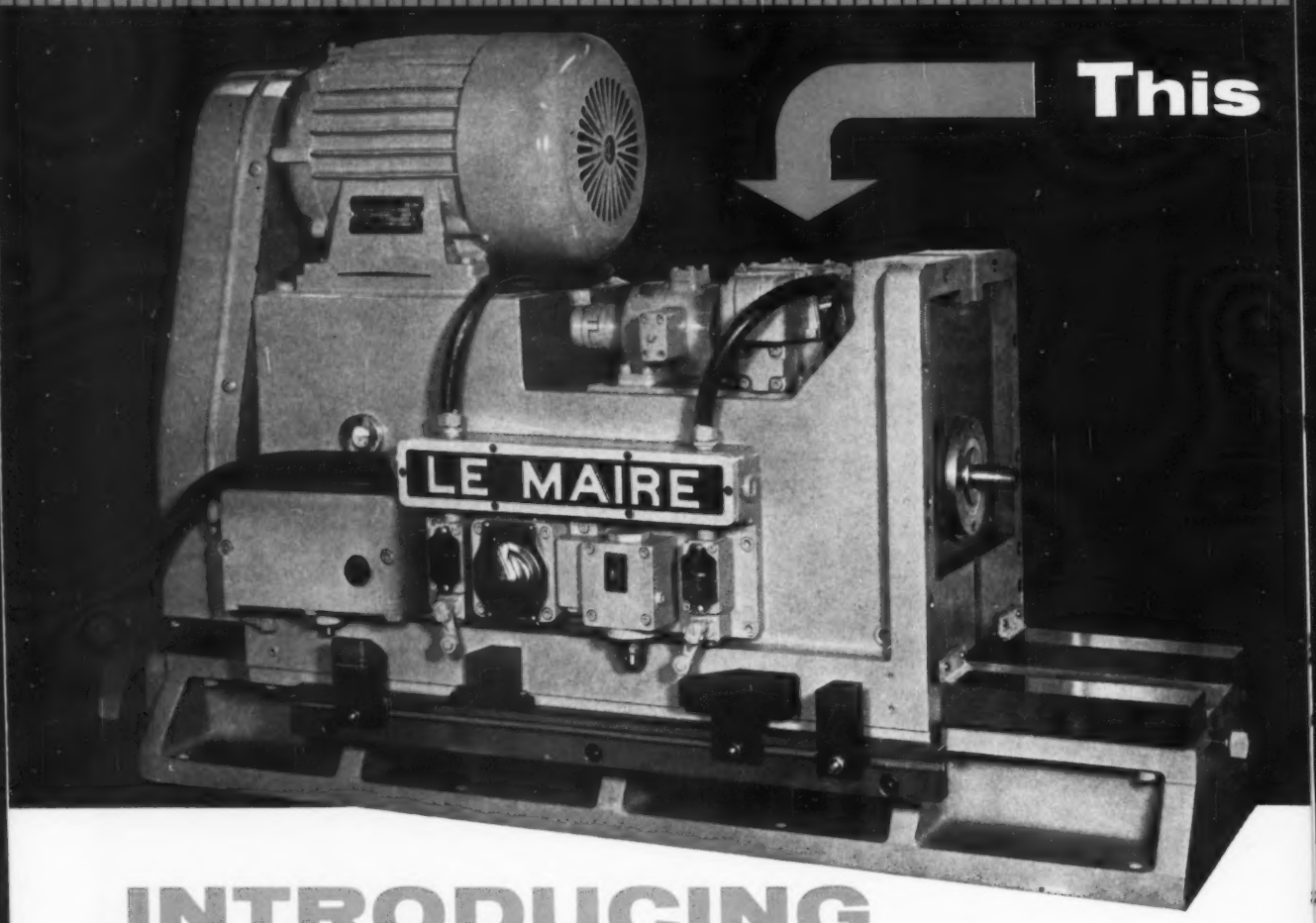
PRODUCING



INTRODUCING

The LE MAIRE SU-5 Unit

Here's real "Building Block" construction for simple, economical automation! For here, on just one rotary indexing machine you'll find six *identical* LeMaire way-type hydraulic units performing nine *different* machining operations . . . with an arrangement which permits easy, rapid change-over to process three different sized parts as required.

The part is a diesel engine rocker shaft bracket. Setups for three different size parts are readily made with adjustable adaptors on the fixtures and adjustable spacers on the milling arbors. Production is 112 pieces per hour at 100% efficiency. Here's what happens at each station.

(1) Load **(2)** Drill large hole **(3)** Spot face and chamfer large hole **(4)** Ream large hole **(5)** Straddle mill top of boss and mounting face **(6)** Drill small cross hole to half depth **(7)** Drill small cross hole to full depth **(8)** Finish mill mounting face **(9)** Finish bore large hole to .0005" tolerance.

The LeMaire SU-5 way-type units used on this machine are extremely suitable as "building blocks" which can be used over and over in widely varied applications. They are entirely self-contained, with cross-keyed construction which permits ready removal and re-mounting. Features of the units include variable delivery pump, hardened and ground ways, automatic lubrication and spindle speed changes. For ease of maintenance and replacement, all component elements are manifolded to provide ready accessibility.

The machine itself features precision balanced spindles for milling and boring, a variable speed pump to power the hydraulic indexing mechanism, automatic lubrication, and J.I.C. electrical and hydraulic systems. Perhaps a similar arrangement of versatile LeMaire way-type units can simplify your production machining problem. Call or write for consultation with a LeMaire field engineer.

with LE MAIRE

Versatile New LE MAIRE Unit Powers Every Operation On This LE MAIRE Machine

LE MAIRE MACHINE TOOL COMPANY

2657 S. TELEGRAPH ROAD
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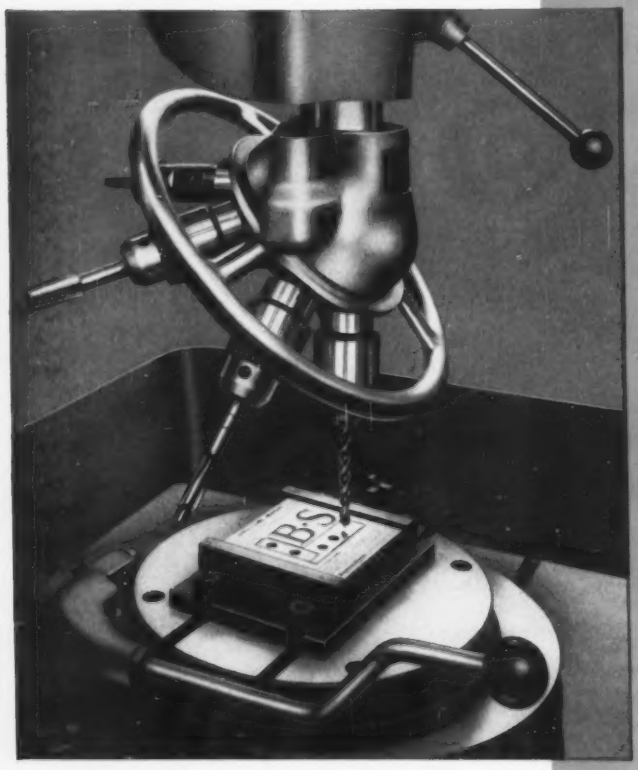
Now... from Brown & Sharpe's the turret drilling machines



The Brown & Sharpe Turret Drilling method utilizes a machine on which all six spindles work on a single axis. As the turret is indexed from spindle to spindle, the tool in use is locked into accurate alignment with the main machine spindle. Simultaneously, the work is rapidly and accurately positioned by means of a Brown & Sharpe work-positioning table.

The result of this technique is an increase in production up to 5 times as compared with conventional multiple or gang-type drill presses.

MODEL A 6 spindles • ½" drilling and tapping capacity in steel • preselective spindle speeds, 200-4000 rpm, infinitely variable, on each spindle • preselective electrical tapping and depth controls on each spindle • table work surface 22"x24"

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that are saving up to 80% in

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- tapping
- boring
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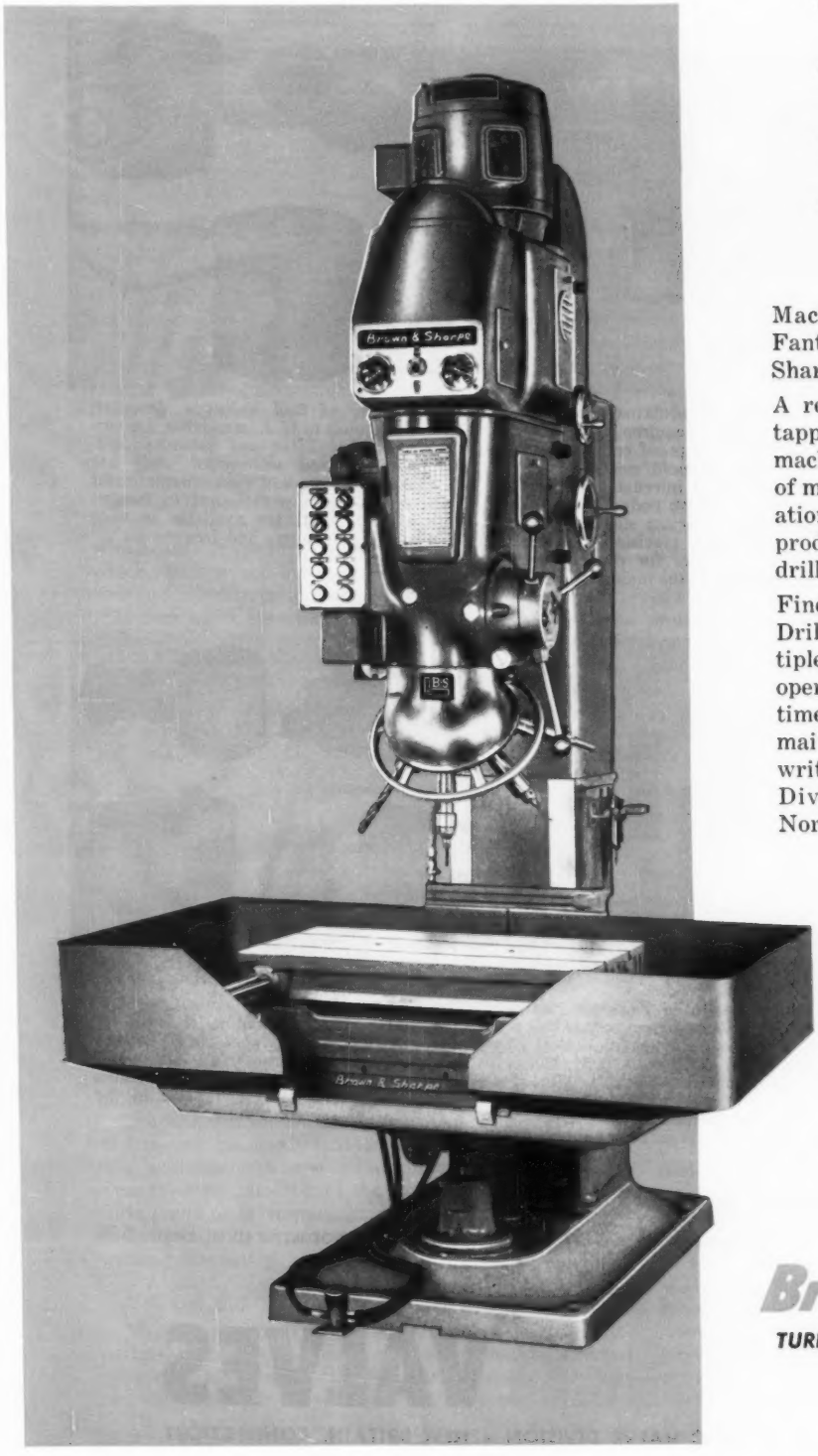


Brown & Sharpe Turret Drilling Machines were developed by Howe & Fant, Inc., now a division of Brown & Sharpe Mfg. Co.

A revolutionary concept in drilling and tapping equipment, these turret drilling machines have been proved over a period of many years in all types of drilling operations, with records of 2 to 5 times greater productivity than with conventional gang drill box–jig methods.

Find out how Brown & Sharpe Turret Drilling Machines can help you make multiple savings in your drilling and tapping operations — in handling time, set-up time, capital investment, floor space and maintenance. For complete information, write: Brown & Sharpe Turret Drilling Division, Inc., 20 Fitch Street, East Norwalk, Connecticut.

MODEL B 6 spindles • 1" capacity in steel • preselective spindle speeds, 125-2000 rpm, infinitely variable on each spindle • preselective spindle feeds, .0025-.021" per revolution, infinitely variable on each spindle • preselective electrical tapping control and depth control on each spindle • preselective turret index, manual or power • table work surface 28" x 32". Machine functions may be combined with any standard numerical control (tape control) system for fully integrated automatic machining and work positioning.

Brown & Sharpe

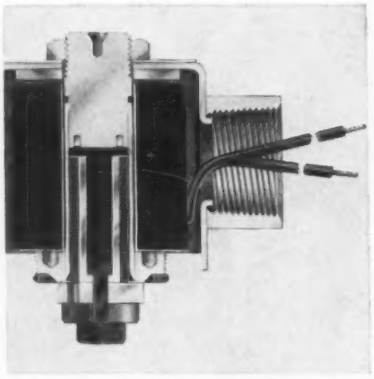
TURRET DRILLING DIVISION, INC.

BS

For more data, circle this page number on inquiry card

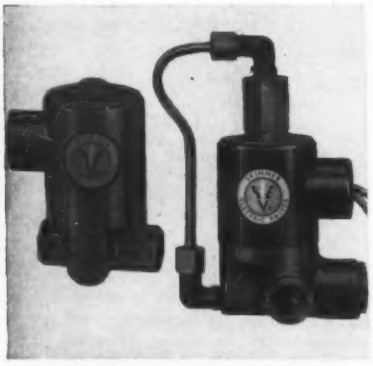
Skinner introduces Two-Way Solenoid Valve for Control of High Pressures

New High Pressure Models just added to the Skinner two-way Type R series line of pilot-operated solenoid valves are offered in two-way normally closed construction only. Orifice size is ¼" diameter with ¼" NPT ports. Operating pressure differentials: 5 to 1250 psi on AC voltages and 5 to 1000 psi on DC voltages. Designed for use with such media as air, oil, water and semi-corrosive liquids.

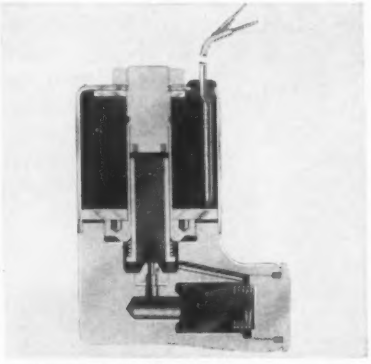


Features. New Skinner Models are built to U. L. requirements in standard and explosion-proof construction. V5-2H type solenoid operator contains stainless steel internal parts to resist corrosion. Valve body is forged naval brass and contains stainless-steel piston assembly, precision machined to close tolerances for positive opening and closing of the main orifice.

Variety of Coil Voltages. Standard coils, built to U. L. standards, are varnish-impregnated and moisture-resistant. Molded waterproof coils are available that will even operate under water and are resistant to fungus growth. Coils are available in wide range of voltages and frequencies.



Standard Pressure Two-way R Series Valves. These two-way valves are available in standard and explosion-proof construction, normally open or normally closed. Pressure operating differentials are 5 to 200 psi for normally closed and 5 to 150 psi for normally open.



Many Desirable Features: Standard pressure R series two-way valves have V5 type operator; stainless steel internal parts; naval brass body; stainless-steel piston assembly; soft synthetic inserts for bubbletight operation. Normally open models have piped-body return. Valve can be mounted in any position.

Custom Installation with these Options. There is a large selection of electrical housings that can be rotated 360° for easy connecting. Also available is manual override that permits opening or closing the valve in the event of current failure.

Skinner Solenoid Valves are distributed nationally.

For complete information, contact a Skinner Representative listed in the Yellow Pages or write us at Dept. 556.

SKINNER ELECTRIC VALVES

THE CREST OF QUALITY THE SKINNER ELECTRIC VALVE DIVISION • NEW BRITAIN, CONNECTICUT

- Industrial Capacity Authority Sought
- New Military Concepts
- Uniform Drafting Specs Required
- Tool-Automation Progress Reported
- Washington Briefs

Keeping up with Washington

Loring F. Overman

PERMANENT AUTHORITY to maintain and expand industrial-mobilization capacity for use in emergencies is sought by the Defense Department in House Resolution 6270, introduced by Carl Vinson (D-Ga.), chairman of the House Armed Services Committee.

"Purpose of the legislation," explained Deputy Defense Secretary Donald Quarles, "is to set forth in a comprehensive, permanent form, the basic authorities needed by the Military Departments in the field of industrial mobilization, procurement, and production."

Facilities defined in the legislation include "plants, buildings, equipment, machine tools, and utilities." The Defense Department official explained that complex modern weapons systems require industrial facilities which are "frequently non-severable in character, and which, because of their specialized nature, cannot be financed entirely by private industry."

H. Res. 6270, for which hearings were to be scheduled soon, would grant permanent authority "for the operation of industrial facilities, and for lay-away, storage, maintenance, or repair of industrial facilities, including privately owned facilities necessary for defense-production or mobilization-reserve purposes in any manner that will make them readily available for use in emergency."

New Military Concepts

Radical changes in types of weapons required for national defense have greatly reduced the need for certain types of plants and facilities held in the Defense Department's National Industrial Reserve.

The NIR's eleventh annual report to Congress revealed that only thirty-one plants remain—a reduction of sixty-one during 1958, in addition to sixty-two released from the reserve during the previous four years. Of the thirty-one left, eleven are in production, and eight others could be in operation within three months. Expenditure of 69.1 million dollars would be required to put all of the plants into full operation—35.4 million for equipment and 33.7 million for buildings.

The National Industrial Equipment Reserve at the end of last year consisted of 3448 items of industrial production equipment whose initial cost was $22,089,333. Twenty-seven hundred of the items were in the metal-cutting and metal-forming groups. During the year, a net decrease of 1293 items was reported, largely in metal-working machinery.

Uniform Drafting Specs Required

Machinery people whose work for the Defense Department includes engineering drawings may be affected by a new uniform specification for procuring drawings and associated lists for use by military forces.

The uniform spec (MIL-D-70327) will replace, in whole or in part, 158 specifications previously used by military departments. Use of these specifications is mandatory in preparing drawings for military departments and their contractors.

Copies are available to contractors through military contracting officers, and copies of a related new standard covering types and definitions of engineering drawings (MIL-STD 7) may be purchased from the Superintendent of Documents, Government Printing Office, Washington 25, D. C.

Tool-Automation Progress Reported

Marked reduction in the need for advanced buying of machined spare parts is a result of machine tool automation, it is reported by General C. S. Irvine, Deputy Chief of Staff for the Air Force. The General explained that one of the less frequently mentioned advantages of tape-controlled machine tools is the feasibility of short production runs. The tapes can then be stored for future use, and the machines put into production quickly when more parts are needed. "This means," said General Irvine, "that for machined parts we will not have to spend millions of dollars in advance in stockpile spares."

Washington Briefs

Among more recent Jules Verne projects in Washington is a feasibility study known as "Project Orion." Involved is a 1000-ton space platform to be propelled by controlled nuclear explosions.

A new type of cost-plus-incentive-fee contract which may set a pattern for future defense dealings has been completed by Navy. This contract, now in use on some plane deals, provides rewards for exceeding performance targets, as well as the penalties required in the past for defaulting. The incentive may provide an added argument for the installation of more efficient machine tools and equipment.

S. 1609, "to provide federal assistance to small business firms adversely affected by U. S. foreign-trade policies," has been introduced by Senator Jacob Javits (R-N. Y.). Similar legislation had been introduced in the 85th Congress by Senator Javits.

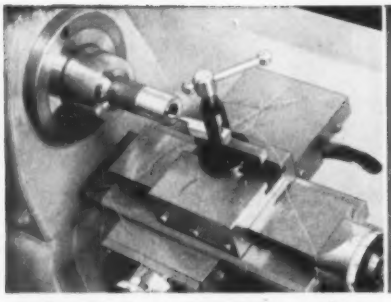
Conceding the importance of a liberal foreign-trade policy, the Senator pointed out that protection for domestic producers was equally deserving of federal assistance.

Hearings were scheduled to open April 22 before the Senate Small-Business Committee to study the subcontracting practices of military prime contractors. Various government agencies have submitted conflicting reports concerning the experiences of small business in the defense program. The current hearings seek a clarification of these reports.

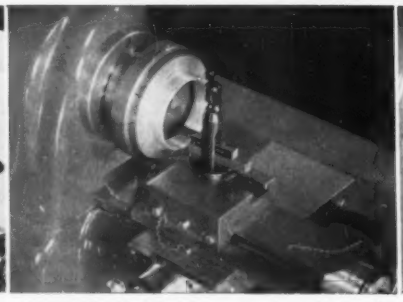
HARDINGE
ELMIRA, N.Y.

HIGH SPEED PRECISION LATHE

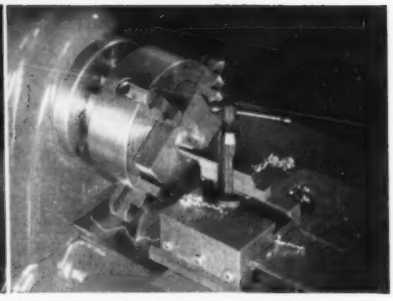
Correct Size - High Speed - Precision Results



Collet Work — The right machine for collet work of 1-1/16" or less diameter.



Step Chuck Work — For rapid and accurate holding of tubing, castings, moldings, stampings and machined parts. Capacity to 6".



Jaw Chuck Work—Integral mount, universal or independent, for extra accuracy. Capacity to 5".

SPECIFICATIONS:
1⅛" Collet Capacity
9" Swing
17" Center Distance
Infinitely Variable Speed
230—3500 r.p.m.

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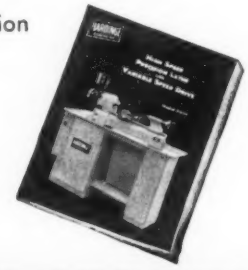

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HARDINGE BROTHERS, INC., ELMIRA, N. Y.
"PERFORMANCE HAS ESTABLISHED LEADERSHIP FOR HARDINGE"

Machinery
JUNE 1959

Education That Will Meet Today's Industrial Needs

THE technological advances that have been proceeding with tremendous impetus during the last few years have imposed higher skill requirements than ever before in many areas of the economy. In the metalworking industries, for example, men engaged in the building and maintenance of automated machinery, electronic computers, television cameras, and other mechanical or electrical products of the last few years must have a knowledge and skill greatly different from those needed in any of the traditional trades.

These technical skills offer greater opportunities than ever before for a large cross-section of our youth. To prepare them for these peculiar skills, however, some changes seem necessary in our educational processes. Particularly, there should be a far greater number of technical institutes to provide specialized education intermediate between that offered by high schools and universities. The technical institutes train men for liaison duties between journeyman mechanics and graduate engineers.

There is also an urgent need for a greater number of vocational schools with truly modern equipment. Upon the extent to which such educational changes are made, and the speed with which they are accomplished, will depend in no small measure the lapse of time that will occur before industry can fully apply the latest technological innovations.

There is some question as to whether more years of basic education should not be provided in grammar and high schools. It would seem apparent that subjects such as mathematics and science should be given greater emphasis in the curriculum of students who are plotting their future in technological fields. Mathematics and scientific subjects should be made far more fascinating to the normal student than is generally the case. Academic subjects should not be eliminated from the curriculum of students who plan to become technicians and scientists because the development of the "whole man" is of utmost importance as well.

Certainly in the field of vocational training there is a definite need for expanded facilities. There are many sections of the country where vocational schools are not available at all for thousands of students. In other communities such schools have not kept pace with the times so far as equipment is concerned.

Gone is the popular conception of past years that vocational schools are primarily for less brilliant pupils. Today, it takes a smart boy or girl to become an expert technician in many phases of industry. Such pupils deserve the best in educational programs designed for their needs and the opportunity of broadening their knowledge along specific lines by taking the usual two-year courses of technical institutes.

There have been times in recent years when a great deal of unemployment has existed among those who are highly educated along academic lines, simultaneously with an acute shortage of technologically skilled workers. If we are to remain the outstanding industrial nation of the world, such situations cannot be permitted to exist.

Charles O. Herb

EDITOR

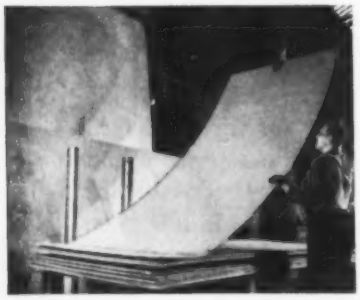
STAINLESS DIRECTORY

Buyers Guide to Ryerson Stainless Stocks & Services

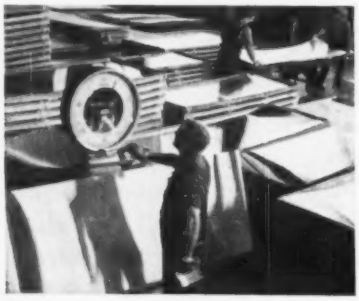
Here's a quick guide to the nation's largest stocks of stainless steel—2,351 sizes, shapes, types and finishes of stainless in stock at Ryerson.

This wide selection assures you of getting the best stainless for every application. Extra care in storage, handling and shipping—such as padded shear clamps to protect finish and flatness of sheets, guards the high quality of Ryerson stainless stocks. And in addition, the help of full-time stainless specialists is yours when you call Ryerson.

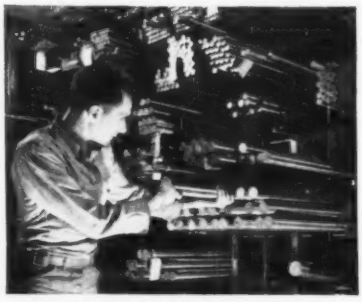
See your Ryerson catalog for a complete listing of stocks and call your nearby Ryerson plant for quick shipment of stainless—any type or size—one piece or a truckload.



PLATES—Available in 9 analyses including plates to Atomic Energy Commission requirements and to ASTM specifications for code work. Also low carbon types for easy welding.



SHEETS—11 analyses of Allegheny stainless sheets in stock including nickel and straight chrome types. Also extra wide sheets to reduce welding costs, expanded and perforated sheets.



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RINGS AND DISCS—Machine cut to your order. This service assures size accuracy, smooth edges, flatness and unaffected corrosion resistance in a lower-cost, ready-to-use product.

HEADS—A.S.M.E. flanged and dished heads in types 304, 304L, 316 and 316L are on hand in large quantities, and in a wide range of gauges and sizes.

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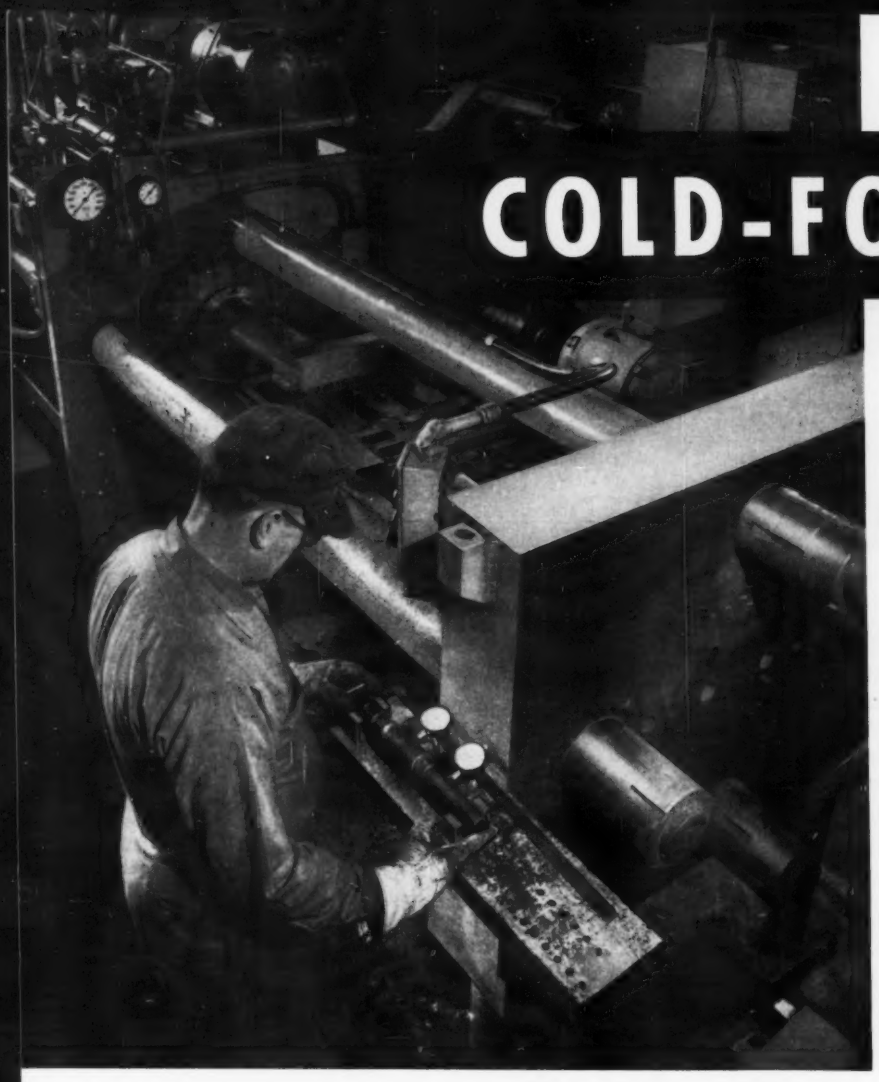


COLD-FORMING of Multiple-Diameter Shafts

HAROLD C. SEIFERT
Manager, Bolt and Nut Division
Republic Steel Corporation
Cleveland, Ohio

Savings in material of up to 40 per cent, greatly reduced machining requirements, and increased strength are some major benefits being realized with cold-formed, multiple-diameter shafts made by the "Die-Form" process. Here are details of the production techniques.

DIE-FORM is a unique method of cold-working blanks cut from hot-rolled steel bar stock into multiple-diameter shafts requiring only finish machining or grinding. In this process, dies are pushed over the blanks from opposite ends and then stripped off. The cold-working operation, which combines extrusion, drawing, and upsetting, can be repeated on either or both ends if further reductions are required. Parts are being mass-produced in this way at the Malvern, Ohio, plant of the Bolt and Nut Division, Republic Steel Corporation, for automobiles, farm equipment, washing machines, refrigerators, electric motors, and similar applications.

Substantially less raw material is required for various parts produced by Die-Forming. Also,

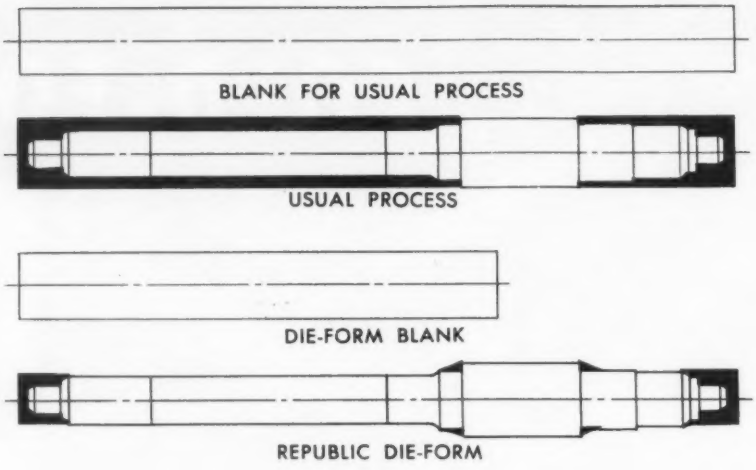


Fig. 1. Top two views show amount of stock ordinarily needed and removed in producing multiple-diameter shafts. Lower views illustrate material savings possible with the Die-Form process.

close tolerances (a total of 0.005 inch on diameters) are maintained in the process. These factors minimize the amount of stock that must be subsequently removed to finish the components as seen in Fig. 1. As a result, material savings have amounted to as much as 40 per cent. For example, in machining an automotive transmission shaft directly from bar stock, 11.75 pounds of steel were required. The Die-Form blank for this part weighs only 7.75 pounds—a saving of 4 pounds or 34 per cent per work-piece. Minimum chip removal also results in increased production, reduced scrap losses, less labor, and lower capital investment for manufacturing equipment.

Another major benefit of the process is the increased tensile strength, yield strength, and hardness resulting from the forging type grain flow and work-hardening of the cold-worked steel. The increases are comparable to those obtained in wire drawing. Some of the results of tests made before and after the process are presented in Fig. 2. On a power take-off shaft for tractors, the tensile strength was increased from 130,000 to 167,000 psi, the yield strength from 115,000 to 150,000 psi, and the hardness from 22 to 30 Rockwell C. In addition to the increases in strength and hardness, the hardness is nearly uniform across the section of the cold-formed part. In some cases the increases are sufficient to eliminate the need for previously required heat-treatment.

Surface-hardening resulting from the cold-working also improves the machinability, the chips produced being more brittle. This eliminates the need for high-sulphur content or leaded steels. In certain instances, cold-rolled steel was required for machining the parts from bar stock. Now, the same parts are being made from Die-Formed hot-rolled steel, thus saving on raw material costs. Smooth surface finishes—generally ranging from 10 to 20 micro-inches—are produced, depending on the surface imperfections on the starting blanks and the condition of the forming dies.

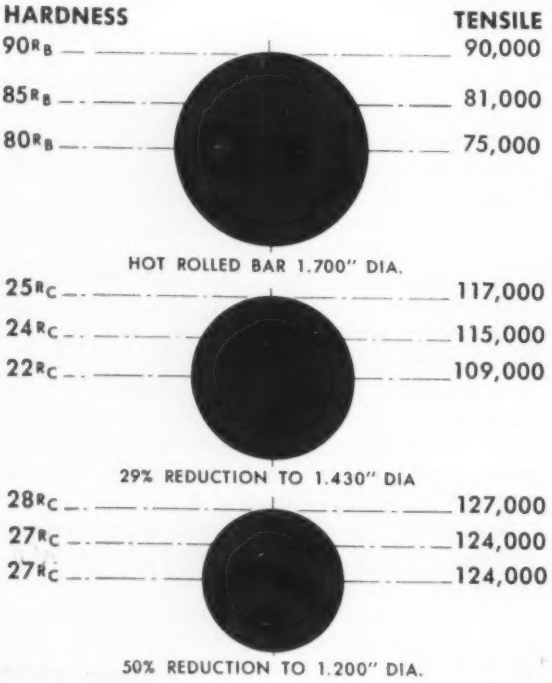


Fig. 2. Increased hardness and tensile strengths resulting from grain flow and work-hardening with different percentages of cold reduction. The hardness is almost uniform across the section of the cold-worked parts.

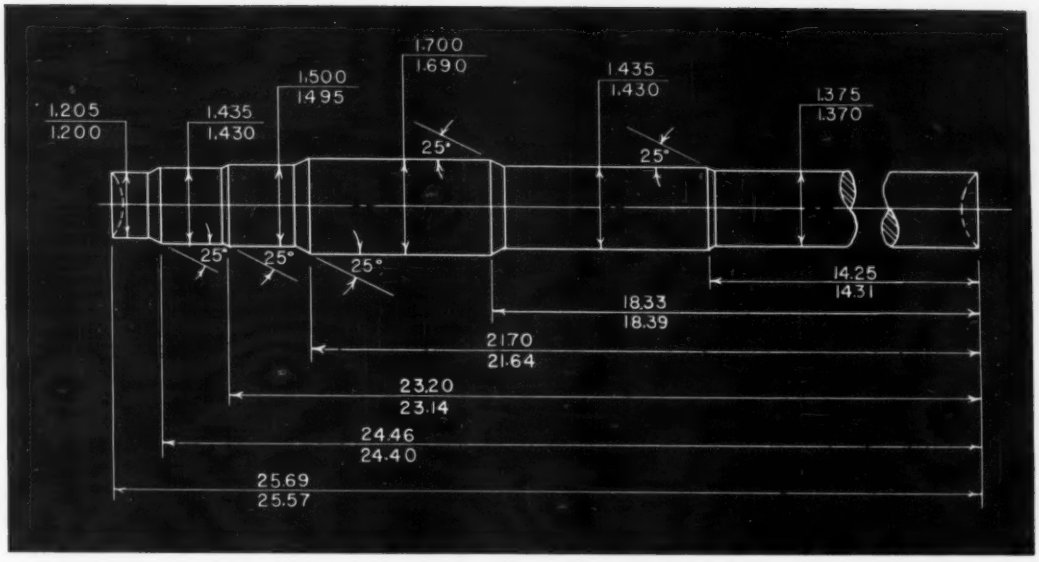


Fig. 3. Typical multiple-diameter shaft that can be cold-formed from blanks of hot-rolled steel bar stock with material savings up to 40 per cent.

Another advantage is the saving resulting from reduced transportation costs due to less shipping weight of the semifinished blanks themselves and the fewer chips produced. Also, an inventory of Die-Formed parts can be stored in a smaller area than a comparable amount of bar stock, and a supply of finished parts can be quickly produced as needed.

Limitations of the Process

The Die-Form process is generally limited to the production of parts having a symmetrical cross-section and two or more surfaces having different diameters. Fig. 3 shows a typical example of a multiple-diameter shaft that can be cold-formed economically in this way. On the other hand, Fig. 4 illustrates a representative part that could not be produced in this manner because of the constricted area or hourglass shape made up of a small-diameter section between two sections of larger diameter. While work-pieces having a symmetrical cross-section are most desirable, there can be exceptions. For example, geared parts have been made for automotive steering-gear components.

Capacity of the presses available at the present time limits the diameter of the blank to be cold-formed to 2 1/8 inches. Upsetting can also be performed, but each different part requires individual analysis and processing based on past experience. The longest shaft produced thus far has been 42 inches.

Since the initial cost of tooling-up for a specific part is comparatively high, the process is economical only for relatively large production quantities. At this stage in the development, Republic is recommending a minimum quantity of 20 tons of any particular part. Screw-machine parts requiring relatively little stock removal are generally cheaper than Die-Formed parts, since the cold-formed work-pieces generally require several loadings, transfers, and unloadings before they are completed.

While a total tolerance of 0.005 inch can be maintained on most diameters of the Die-Formed

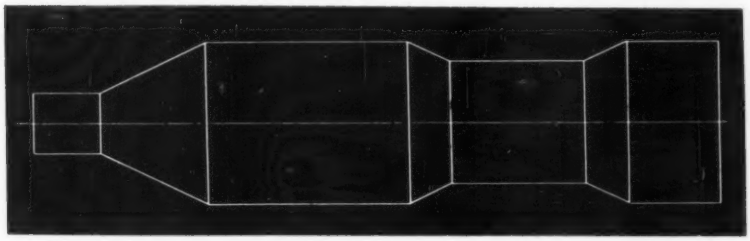


Fig. 4. Hourglass shape of this part prevents it from being made by the Die-Form process. Also, the large reduction in area (about 80 per cent) exceeds that practicable with this method.

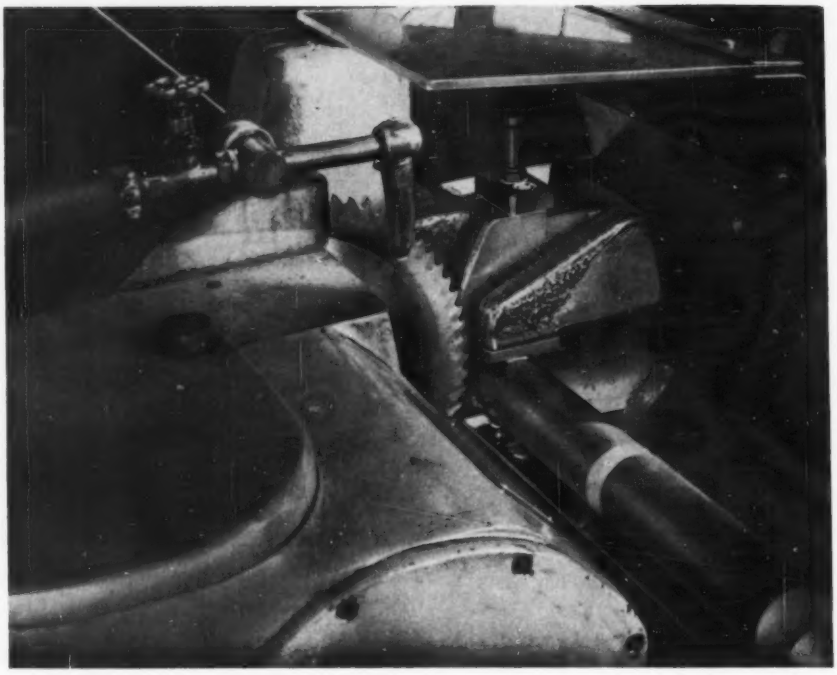


Fig. 5. (Right) Larger diameter blanks are cut from hot-rolled steel bar stock on this hydraulic saw. Automatic cycling includes advancing the bar, clamping it, and feeding the saw carriage.

Fig. 6. (Below) Prior to cold-working, the blanks are successively immersed in five tanks for cleaning, hot-water rinsing, phosphate-coating, cold-water rinsing, and lubricating.

parts, more allowance may be required when the surface is adjacent to an upset area. The tolerance on lengths, measured from shoulders, is 0.063 inch, and straightness can generally be held within 0.010 to 0.030 inch, depending on the nature of the part.

Materials That Can Be Die-Formed

Hot-rolled bar stock to be cold-worked in this way must be of sound (bar-quality) structure, and have clean surfaces. Cleanliness and freedom from scale is insured by pickling or mechanically descaling (steel-shot blasting) the bars. For certain applications, the bars may require straightening. Regular AISI bar-diameter tolerances (plus or minus 1/64 inch on bars 1 1/2 inches in diameter) are satisfactory.

The process has been used successfully for the mass production of parts made from plain carbon and alloy steels containing up to 0.60 per cent carbon. However, this is not a limitation. Among the materials cold-formed are AISI 1010, 1020, 1024, 1037, 4150, 5120, and 8620 steel. Cold-working of the 1024 steel is unique from the standpoint of the high manganese content (1.35 to 1.65 per cent). Of the materials formed in production, the chromium-molybdenum steel, AISI 4150, has been the toughest to form. The most suitable materials are those that do not

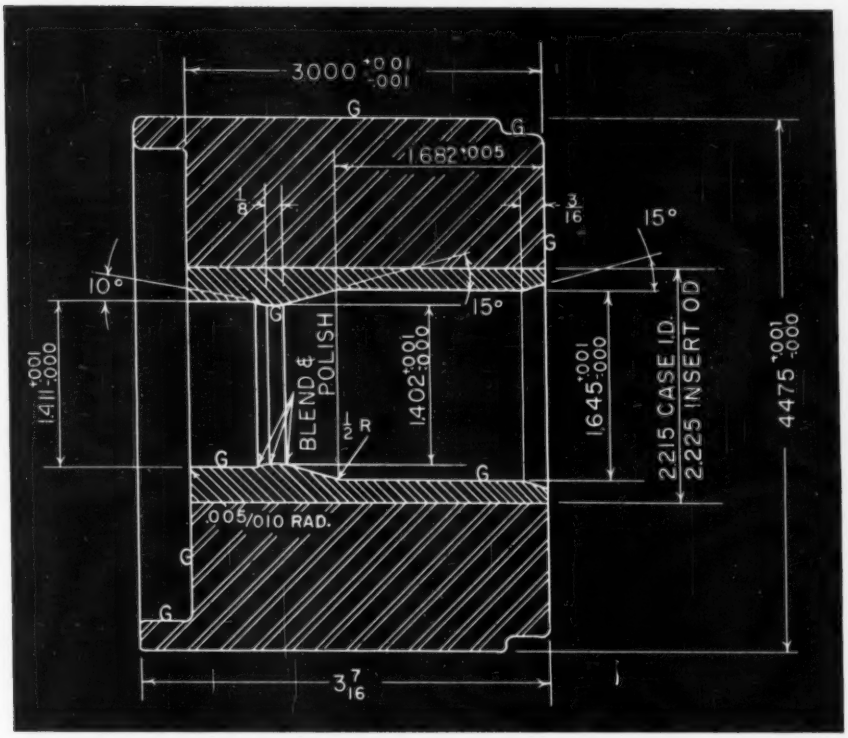


Fig. 7. Cross-sectional drawing of a die used in forming power take-off, rear transmission shafts. Tool-steel die insert is hardened to 59 Rockwell C, and casing, 45 Rockwell C.

work-harden too rapidly. Stainless steels have also been formed successfully on an experimental basis.

Bars are cut into blanks of the required length on either shears or saws. The hydraulic shears, designed and built by Republic, are used to produce blanks up to 1 7/8 inches in diameter and weighing from 1 1/2 to 20 pounds. On some blanks, particularly those to be used in closed dies, the total weight tolerance is held to 1/4 ounce, while on others, it may be as much as 1 1/2 ounces. Bars 1 7/8 inches or more in diameter are cut into blanks on Heller hydraulic saws, such as the one shown in Fig. 5. These machines automatically grip the stock, advance it to a stop, clamp it, and feed the saw carriage. After sawing, the carriage is retracted, the bar unclamped, and the cycle repeated until an entire bar length is consumed.

The blanks are then cleaned, phosphate-coated, and lubricated by immersing in five separate tanks, Fig. 6. The cycle consists of a five-minute dip in a Parcolene bath maintained at a temperature between 170 and 175 degrees F.; a one-minute hot-water rinse (150 to 190 degrees F.); a five-minute dip in a Bonderite 70-point solution held at a temperature of 160 to 170 degrees F.; a one-minute cold-water rinse; and a five-minute dip in a Bonderlube bath maintained at a temperature between 140 and 150 degrees F. Parcolene is a cleaning agent; Bonderite, a phosphate coating compound; and Bonderlube, a soap lubricant—all made by the Parker Rust Proof Co. For certain parts, this cycle must be repeated between cold-working operations, but this is usually not necessary. When required, the old lubricant must be removed before re-coating.

Processes and Tools for Die-Forming

Die-Forming is performed on horizontal hydraulic presses such as the one seen in the heading illustration, specially designed and built for the process by Republic. Each press has from two to four die stations and an adjustable stroke. The stationary platen side of the press carries one die carriage, and the moving ram side, the other carriage. Die inserts are pressed into retainers mounted on the carriages.

The operator manually transfers the work-pieces from station to station, and places a new blank between the pair of dies at the first station. In this way, a finished part is completed with each press stroke. A work-holding cradle, which pivots out of the way as the die on the moving ram contacts the part, is provided at each station. In the case of closed dies, pressure builds up when the mating die faces come into contact, and a reversing valve causes the ram to return to its

starting position. For open dies, limit switches are used to reverse the press ram.

In high-production runs of Die-Formed parts, die inserts are made from carbide. When smaller quantities are required, the inserts are made of an air- or oil-hardening tool steel such as Republic 12-H-W. This material is essentially a hot-work steel being used for cold-working with good results, and contains the following percentages: 0.53 carbon, 0.35 manganese, 1.00 silicon, 5.00 chromium, 1.00 vanadium, 1.50 nickel, and 1.75 molybdenum.

After machining, the tool-steel inserts are annealed, hardened, and drawn to a hardness between 58 and 60 Rockwell C. Then the die inserts are ground, and the approach, extruding, and bearing surfaces are blended and polished. Retainer casings for the die inserts are made from a steel such as AISI 4147, which is heat-treated to attain a hardness of between 43 and 47 Rockwell C.

A cross-sectional drawing of a typical die is presented in Fig. 7. For this particular tool, the die insert is pressed into the retainer casing with an interference fit of 0.010 inch between the insert diameter and casing bore. The tool is used for the final operation in the three-stage forming of power take-off, rear transmission shafts from AISI 1045 steel. Starting with a round bar 1 5/8 inches in diameter by 33 1/4 inches long, the part is progressively reduced to a diameter of 1.405 inches by 4 1/4 inches long on one end and 1.390 inches in diameter by 34 1/4 inches long on the other end. Over-all length of the shaft is increased to 41.63 inches. While this amount of reduction could be accomplished in a single operation, forming is performed in three stages to prevent buckling due to the substantial length of the part.

Life of the die inserts varies with the design of the part being formed, the material from which it is made, and the amount of reduction performed. One of the most reliable yardsticks in estimating die life is the footage of steel that passes through the die.

The heading illustration shows the setup on one of the hydraulic presses for producing truck-transmission main shafts from AISI C-1024 steel bar stock. Only two of the three available stations on this machine are used in this operation. In the heading illustration, the operator is shown checking the concentricity and runout of one of the Die-Formed shafts.

A front-wheel spindle, used by the Cadillac Motor Car Division of General Motors Corporation, and the blank from which it is formed are illustrated in Fig. 8. These spindles previously required considerably more machining than the Die-Formed parts now used. Blanks, such as the one seen at the top, are 1 9/16 inches in diameter by 5 5/8 inches long, sheared from hot-rolled, AISI C-1037 steel bars. Over-all length of the completed part (bottom) is 7.40 inches, and the small end is only 0.955 inch in diameter. This represents a total reduction in area of 62 per cent. A tapered surface having a 6-degree angle (per side) and a length of 1 1/4 inches is formed near the center of the spindle, and flats are produced on the large-diameter end in this same operation.

Transmission shafts, such as the one seen in Fig. 3, are made from AISI C-1024 steel having a modified silicon content of 0.15 to 0.30 per cent, and a fine-grain microstructure. All of the various diameter surfaces are maintained concentric with each other and straight within 0.010 inch total indicator reading.

Blanks used for transmission output shafts are 2 1/16 inches in diameter by 6 1/4 inches long, made from AISI 8620 steel. Completed shafts have an over-all length of 10.81 inches, and seven different diameters ranging from 1.295 to 2.070 inches.

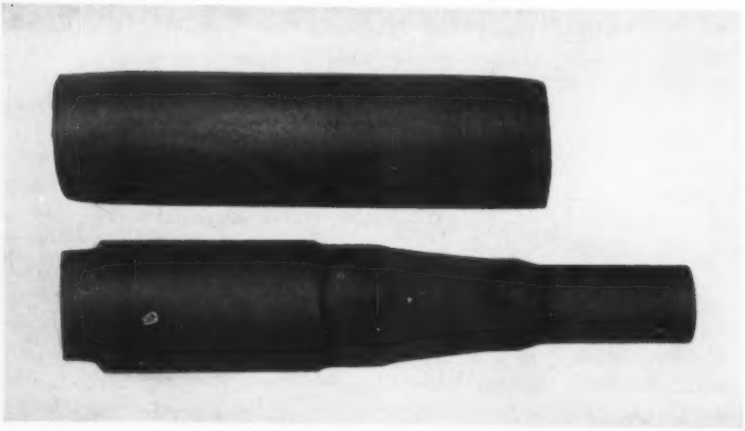


Fig. 8. Front-wheel spindle, 7.40 inches long, used in Cadillac automobiles. Blank, seen at the top, is 1 9/16 inches in diameter by 5 5/8 inches long.

Fig. 1. Portion of a grinding machine showing a wheel and the hardened crusher roll. During crush forming, the wheel is pressed radially against the roll and turned slowly.

HERBERT CHASE

VERSATILE APPLICATION OF CRUSH FORM GRINDING

GRINDING with crush-formed wheels is an operation much in evidence at the Buick Motor Division, Flint, Mich. Applications include not only the grinding of work-pieces having irregular contours, but the deburring and chamfering of small pinion teeth. In addition, the method is employed to make special form tools. Production economies and several advantages in tooling have been the result.

Front sun gears for "Triple Turbine" transmissions are among the parts on which crush form grinding has proved useful. A stepped contour is ground in the periphery of these gears. The wheel used is shown being crush-formed in a Sheffield grinding machine. This is done by slowly rotating and pressing the wheel against a hardened-steel roll of the required shape. The roll, seen above the wheel in Fig. 1, has a wide center land that does most of the crushing. A stepped contour is located at each side of the land, but only one end of the roll is used at a time. Thus, since the roll is symmetrical, it can be turned end for end on its spindle after significant wear occurs. In Fig. 2 the crush-formed wheel is shown grinding the step.

It is necessary to hold the edge of the step parallel with the gear face within 0.0003 inch. In the setup, the gear is centered by a short expanding arbor projecting from the face of a chuck against which the work is clamped. The steps, which are from 0.010 to 0.015 inch deep,

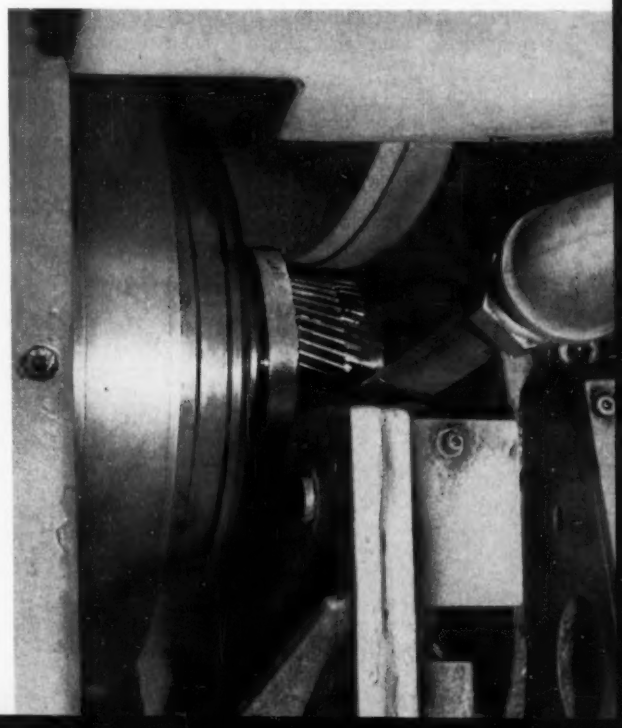


Fig. 2. Here, crush-formed wheel shown in Fig. 1 is seen (from above) in position for grinding stepped contour in the periphery of an automobile transmission gear.

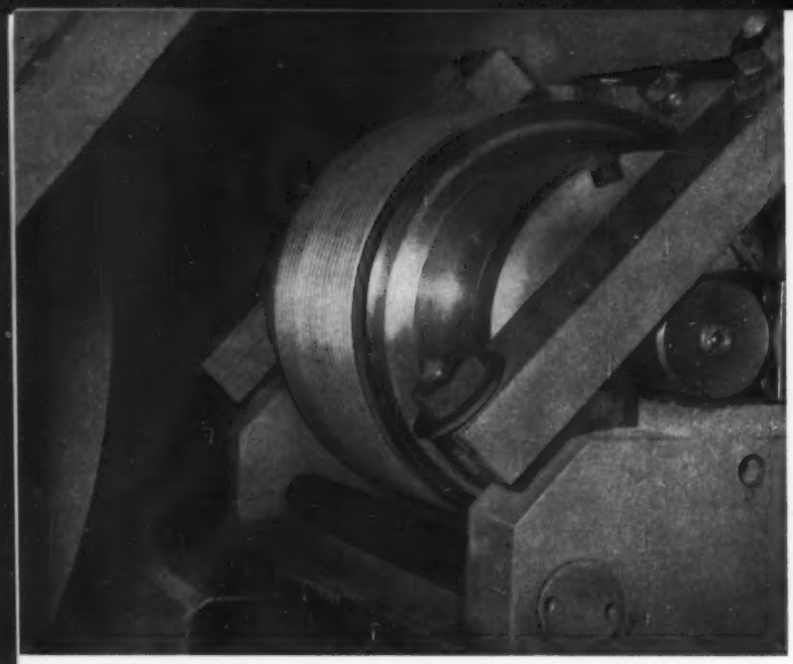


Fig. 3. Crusher roll that produces serrations in the face of a grinding wheel used to deburr the ends of pinion teeth. The wheel is crush-formed every four hours during the operation.

are produced in plunge cuts. Forty to sixty pieces can be ground before the wheel needs re-crushing. For this application, a Simonds Worden White wheel is used. It is made of 80-grain-size aluminum oxide held in a vitrified bond and is operated at about 5500 surface feet per minute.

Another job done with a crush-formed grinding wheel is the deburring of small helical spur gears. In Fig. 3, a roller for crush forming the wheel used for this operation is shown mounted in a Sheffield grinding machine. The grinding wheel is given V-shaped serrations into which the gear teeth enter as the pinions roll across the face of the wheel. The teeth do not fit the serrations closely but rather contact the wheel only on the edges where the burrs are to be removed.

For rapid production, the setup (Fig. 4) is arranged so that the pinions feed automatically down a chute and into a magazine. As they approach the wheel, the pinions contact a V-belt that causes them to rotate slowly in passing across the serrated face. This rotation enables all teeth of each pinion to contact the 4-inch wheel face. After traversing the wheel face, the pinions are free of burrs on all contacted surfaces. Production has to be stopped for a short period about every four hours to permit crush forming of the wheel.

In another case, deburring or chamfering of tooth ends is accomplished in a Lamb deburring grinder, Fig. 5. The pinions, two of which can be seen at the left in the illustration, are rotated in the machine by frictional contact with a belt. They also engage a rack that is precisely located in reference to the crush-formed wheel face. There is thus a positive advance of the work-

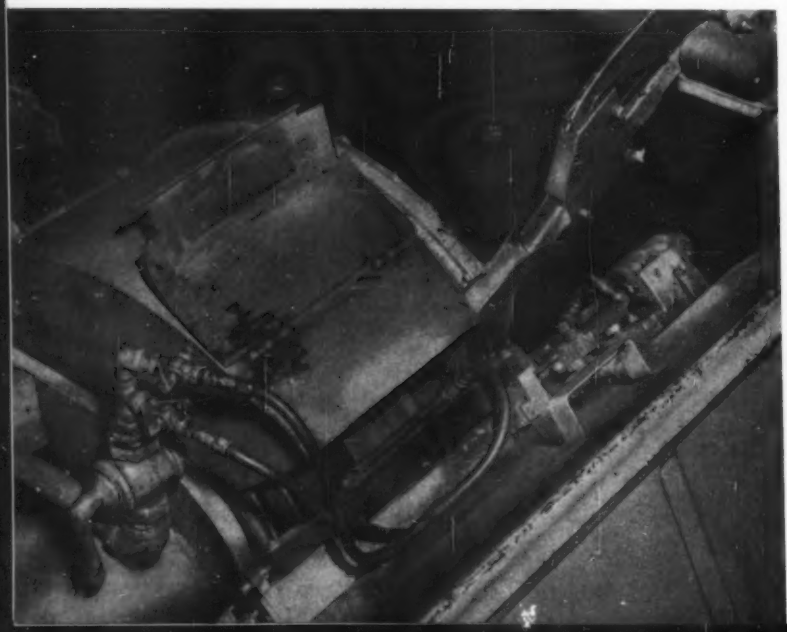


Fig. 4. For deburring, pinions are carried across the wheel face by a belt that causes them to rotate, bringing successive teeth into contact with the serrations.

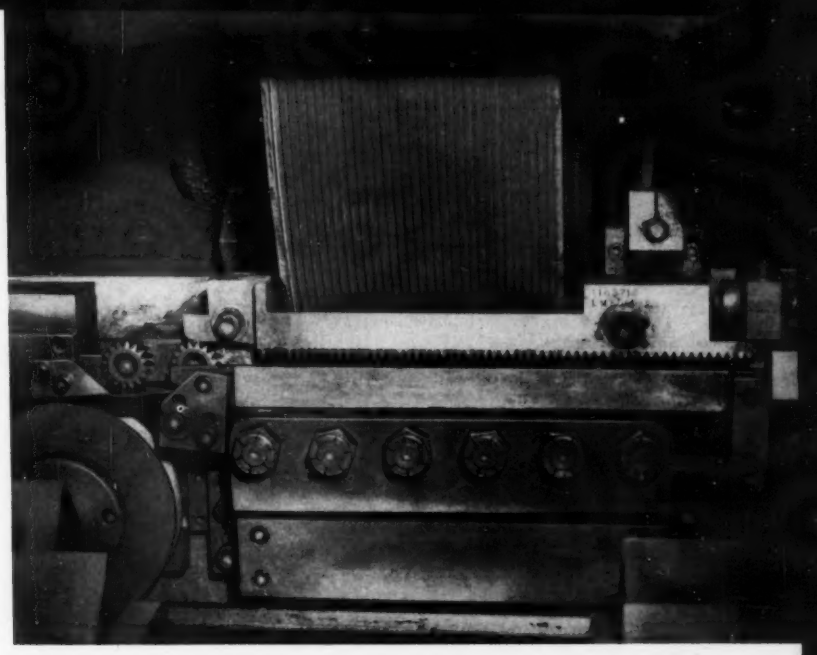


Fig. 5. This grinding machine also has a serrated wheel but is used to chamfer both ends of pinion teeth. A rack engages the teeth and causes the pinions to rotate as they traverse the wheel on a belt.

pieces to contact with the serrated wheel surfaces that do the chamfering. The feed for this setup is also mechanized. Since chamfering must be done at both ends of the teeth, the pinions are passed through the grinder twice, two belts being used. With the new method, production is many times that formerly obtained.

Crush-formed wheels are also employed by Buick for the grinding of form tools. Accordingly, the company has equipment in one of its toolrooms to produce the crusher rolls, to crush-form wheels with these rolls, and then to use the wheels to grind the form tools. Sixteen different form tools are employed in machining crankshafts. Since crankshafts are produced in large volume, many sets of tools are needed for this purpose alone.

Once a wheel has been crush-formed, it can be used to grind the irregular surface of a single form tool in about twenty minutes. If this work were done with standard wheels, the time required per form tool would be about five to six hours. Thus, much time is saved. But it is first necessary to provide crushing rolls and then use them to crush-form a wheel or wheels. In general, however, roll production is not difficult and crush forming is very quickly done.

Crusher rolls are commonly ground on a Brown & Sharpe grinder in setups of the type seen in Fig. 6. The roll is supported on an arbor. A Bay State 150-grain-size aluminum-oxide wheel with a vitrified bond, turning at 3600 rpm, is typical of those employed for this work. A diamond secured in a pivoted holder is used to shape and dress grinding wheels that cut specified radii. Even the most complicated shape roll requires

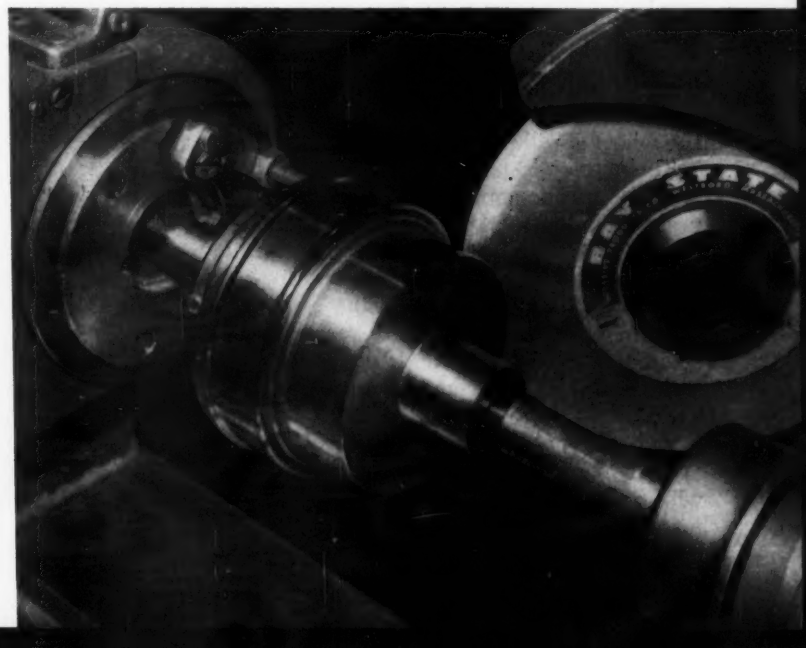


Fig. 6. Here, a portion of a crusher roll is being ground by a wheel dressed to produce a fillet. The work-piece is supported in the machine on an arbor.

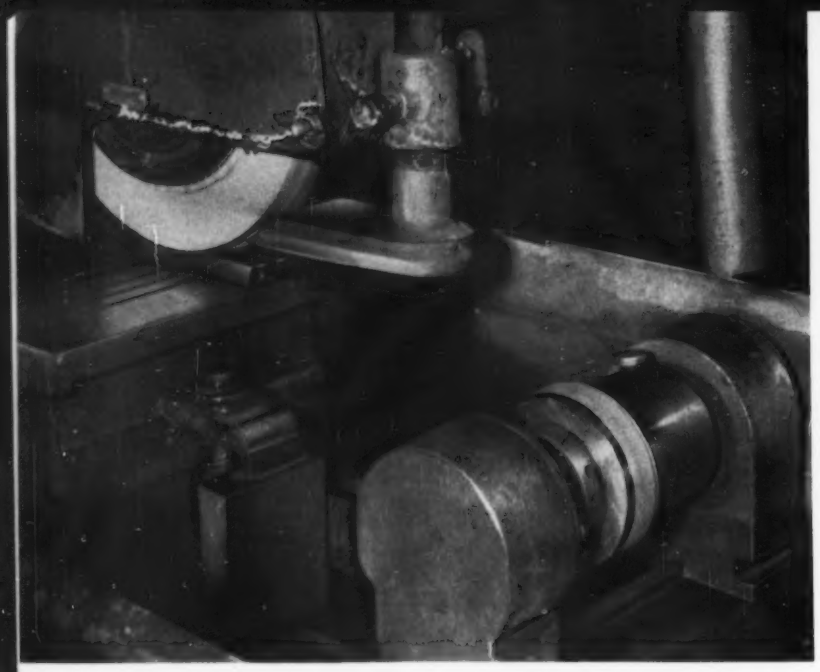


Fig. 7. (Left) A crush-formed wheel is used on this surface grinder to produce form tools. At the right, on its own arbor supported in bearings, is the roll made to crush-form the wheel face prior to grinding.

Fig. 8. (Below) Portion of a grinding wheel (top) whose face has been crush-formed by the hardened roll below. At the right is a flat tool whose surface has been form-ground by the wheel.

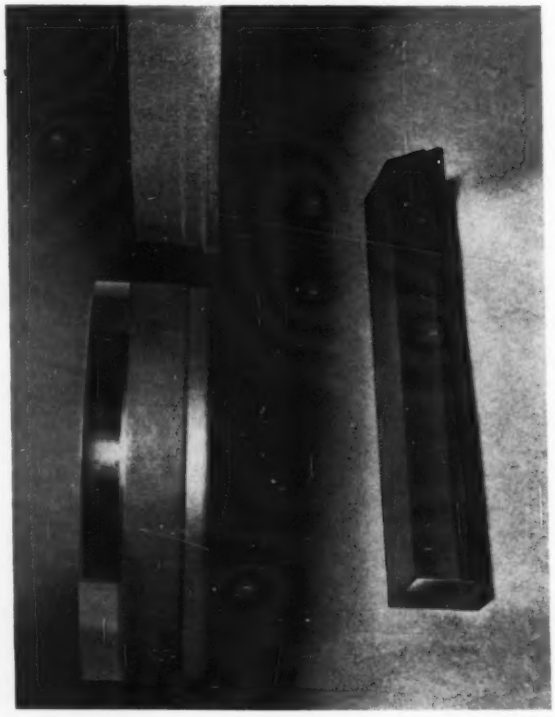
no more than three hours for grinding. The rolls are commonly made from high-speed steel and when worn are readily reground.

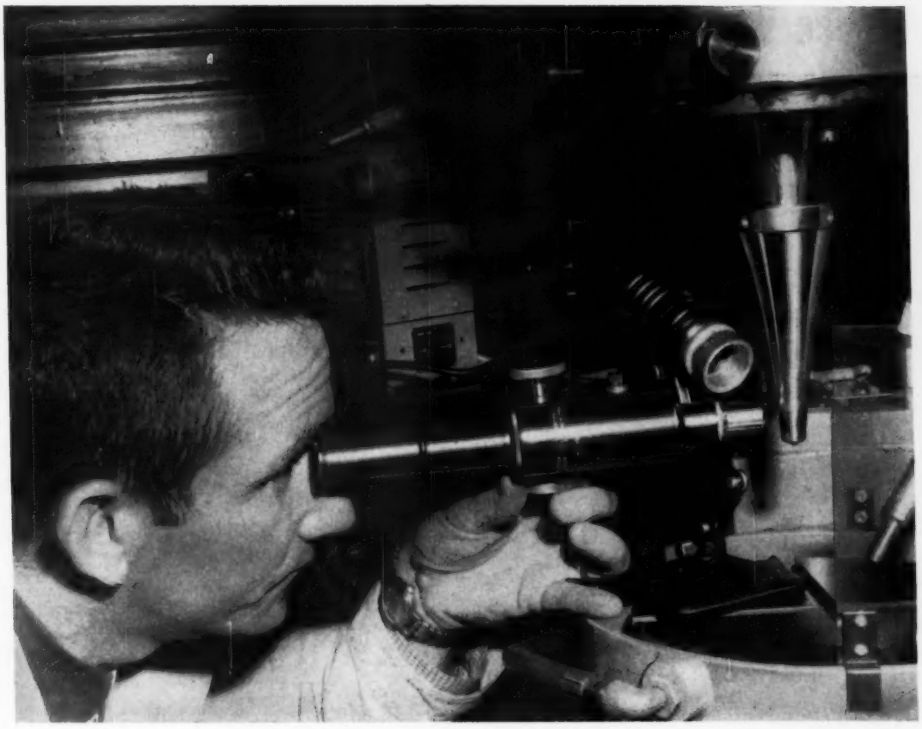
Thompson surface grinders (Fig. 7) are employed for grinding the form tools. A crusher roll, mounted as shown, is used both to crush-form the wheel initially and to repeat the operation as necessary. Special bearings support the arbor that holds the crusher roll. In crush forming, the 12-inch-diameter wheel used is driven at 38 rpm and is fed against the roll in increments of about 0.0005 inch at the rate of about 0.0025 inch a minute. This is done under a flood of soda-water coolant and with a brush applied against the roll to remove grit.

Form tools to be ground are placed on a magnetic chuck on the grinder table in the usual manner, and an indicator employed to align the tool in correct relation to the roll. When more than one tool of the same shape are to be ground, they are set end to end in a row of up to five or six and all ground simultaneously. A portion of a crush-formed wheel, the roll employed for crushing, and a form tool that has been contour-ground by the wheel are illustrated in Fig. 8.

Tools ground in this manner are checked by a 10 to 1 optical comparator. If they are not within prescribed limits, they may be shifted slightly from side to side or the roll may be reground to correct the deviation. Tools returned for regrinding after use are checked by the comparator to determine how deep a cut is required. Wheels commonly used are about 12 inches in diameter and operate at 1750 rpm when grinding. In general, a crush-formed wheel can grind about fifty tools before another crush forming is needed.

Machines not designed especially for grinding with crush-formed wheels perform well on production operations. In addition, a conventional grinding machine can be used for toolroom work. The machine, however, must be provided with an arbor having bearings and supports to hold the crusher roll and with means for turning the grinding wheel at low speed when crush forming is done. At the low wheel speed used, it is not necessary to apply heavy pressure to crush the wheel face. Both in crushing and in grinding, a flood of coolant is needed in order to keep the wheel from loading.





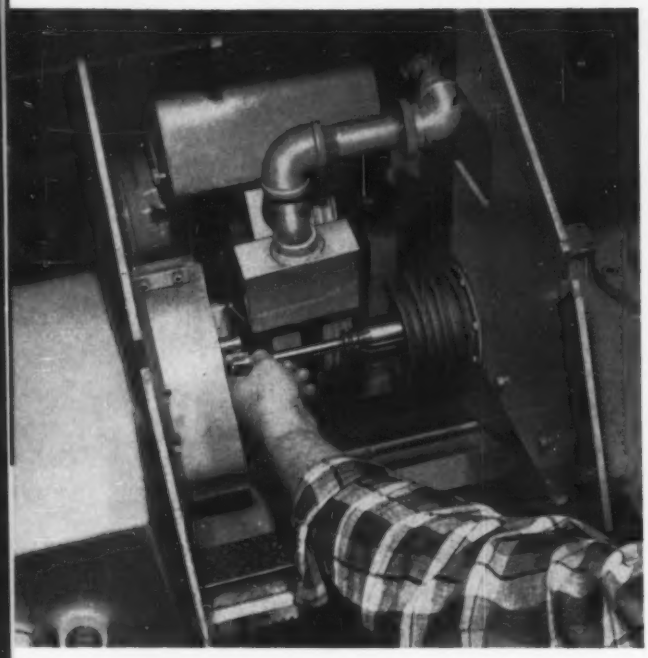
Using an optical microscope, the technician adjusts the tool amplitude of a Sheffield Cavitron. This ultrasonic equipment cuts portholes in stainless-steel servo valve sleeves having a hardness of 60 Rockwell C. The holes are 0.050 inch wide, 0.120 inch long, and are cut in a wall about 1/16 inch thick. Size is held within 0.0005 inch.

CHANCE VOUGHT
Opens New Hydraulic Facility

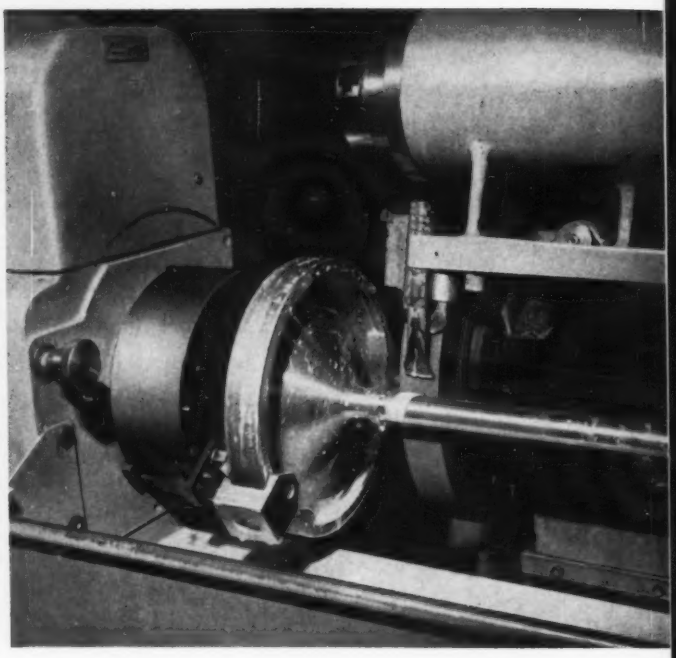
PRECISION CYLINDERS, pumps, valves, and servo systems for F8U Crusader fighter planes are being made in a new $1,000,000 hydraulic research and manufacturing facility at Chance Vought Aircraft, Dallas, Tex. The installation includes ultrasonic cutting and cleaning equipment, crush and optical grinders, a gun-drilling machine, a tracer-controlled milling machine, and six different honing machines for cylinders up to 14 inches in diameter. Also available is a swaging machine with a capacity for 3-inch tubing having a 5/16-inch wall.

The plant has facilities for testing cylinders at pressures up to 5000 psi. Inspection equipment assures quality control to a tolerance of 0.00001 inch. Included in the 20,000 square feet of floor space is a "cold room" where dust, temperature, and humidity are closely controlled. Here, close-tolerance assembly and test work are done. In addition to the production of "hardware" for Crusaders, research and development work is in progress on new hydraulic components for various projects. Chance Vought has been making its own hydraulic assemblies for years in its experimental area, and the new plant will enable it to undertake quantity development and production.

Chance Vought Opens New Hydraulic Facility *(Continued)*

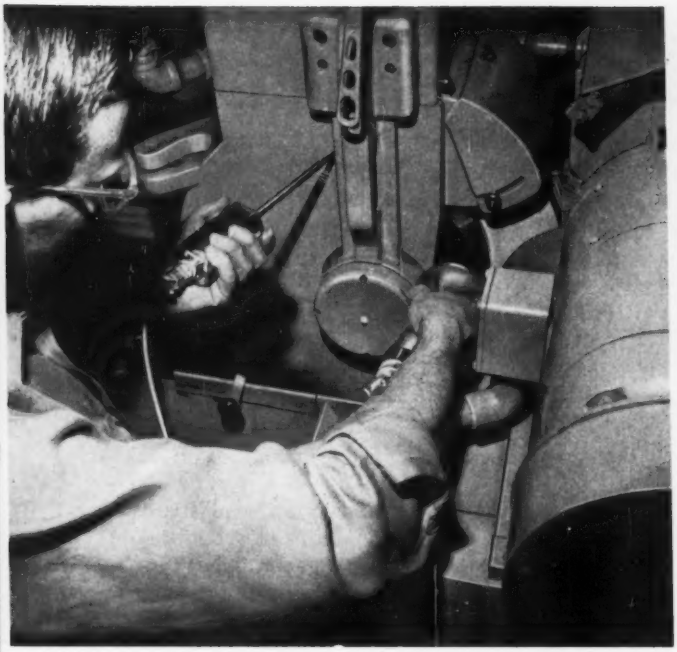


A slot in a piston for a hydraulic assembly is plunge-ground on this Sheffield Crushtrue machine in a cycle time of fifty seconds. Head end, two radii, and different angles on slot sides are formed simultaneously. Previously, ten different grinding setups were required to do the same job.



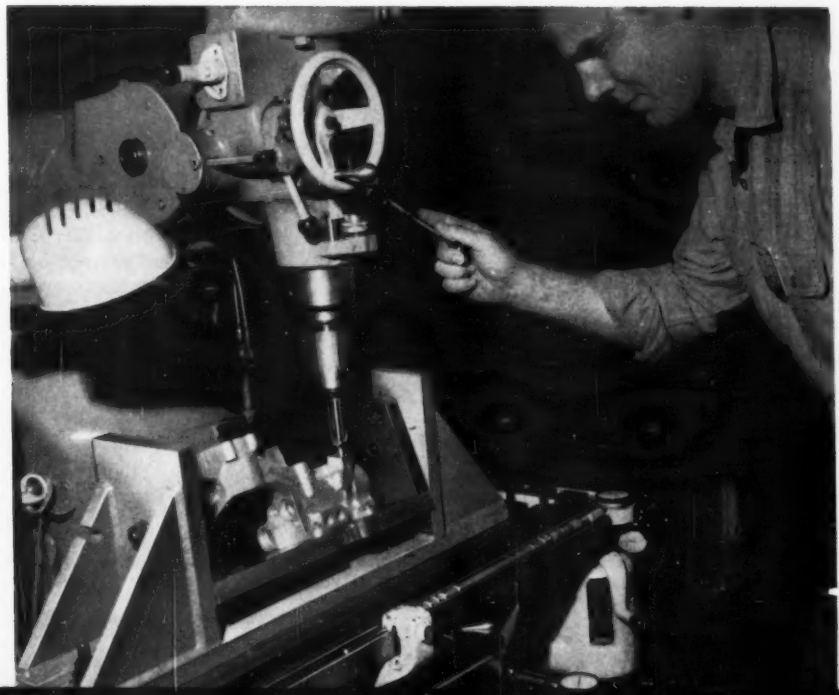
The integral hollow stem of the aluminum piston used in a hydraulic reservoir is ground on this Cincinnati universal center type machine prior to chromium plating. To eliminate chatter and allow faster stock removal, the 14-inch long stem is filled with steel shot before grinding.

Gun-drilling a blind hole 15 inches deep in each end of a steel piston for a hydraulic actuator. The machine, an Ex-Cell-O Bor-Dril, is used to rough- and finish-drill interconnecting holes as well as long, deep holes. In some instances, 0.002 inch of material is left for a honing operation. Holes produced are straight —ideal for complicated pistons and barrels.



Wheels are carefully balanced with a probe and stroboscopic light. The dial on the probe, which is held against the machine, registers the amount of vibration. The stroboscopic light indicates the direction of the out-of-balance. Weights are then moved in the wheel hub until wheel is in balance.

Inspecting the finish of a chromium-plated ground piston stem with a Brush Surfindicator. Finishes are held to 4 micro-inches. The instrument pick-up is supported from a reciprocating motor drive-box which advances it over the entire length of the stem at 1/8 inch per second.



Counterboring a cylinder porthole on a Bridgeport milling machine. Supported in a trunnion fixture, the work is indexed around a horizontal axis to nine different angle-drilling positions. Use of the fixture has saved four hours of layout time over a former machining method.

EXPLOSIVE-FORMING MEETS SPACE-AGE PRODUCTION DEMANDS

Methods, advantages and limitations, current status, and future possibilities of explosive-forming are discussed—based on a recent cross-country survey of applications by the author.

P. F. LAMBERT, Vice-President
The Talco Engineering Co., Redondo Beach, Calif.

TODAY'S SPACE AGE demands the production of metal structures having performance characteristics far beyond those previously thought possible. Required characteristics are higher strength, minimum weight, strength and form-retention under both low and high temperatures, large size, extreme precision, resistance to corrosion and erosion, protection against radiation, and rapid, low-cost methods of production.

Explosive-forming is a relatively new, little-explored method that offers possible solutions to some of the metal-forming problems currently being faced. However, full utilization of this technique will require more research and close cooperation between explosive engineers, tool and die engineers, and metallurgists. Properly used, explosive-forming offers almost unlimited energy possibilities, but most important is the available *rate* of energy application.

There are two distinct methods of explosive-forming:

1. Pressure-forming with propellant type explosives.

2. Shock-forming with high-order explosives.

Pressure-forming must be done in a closed system to effectively use the pressure generated by the burning propellant. With this method, pressure-time curves can be controlled over a wide range. For example, the pressure can be built up slowly at the start of the cycle, with peak pressure at the end of the cycle. This curve can be reversed, with peak pressure at the beginning; or the peak can be at the middle or any other position along the curve. The pressure can be varied to more than 200,000 psi, and the time cycle controlled from milliseconds to several seconds.

With pressure-forming, the metal may be moved at a predetermined rate by selecting the

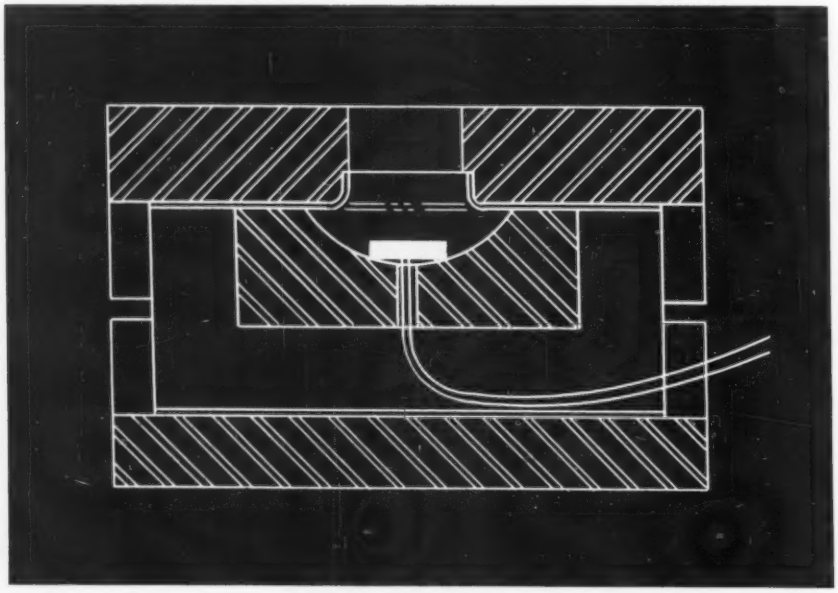


Fig. 1. Explosive-pressure-forming setup in which an exterior boss is produced on a cylindrical tube.

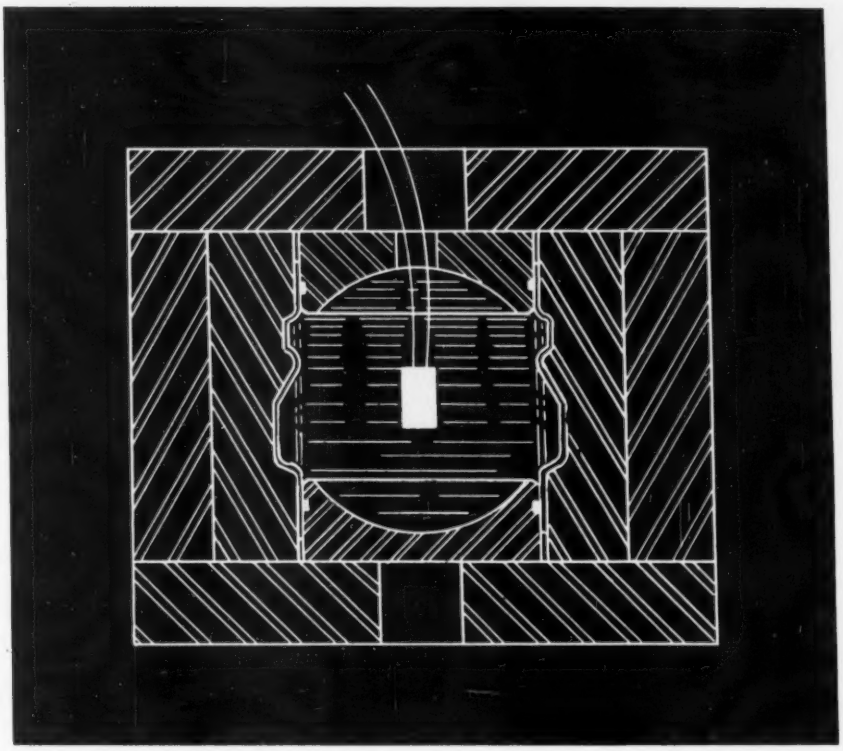


Fig. 2. Hydraulic medium is used to transmit pressure in this explosive-forming operation for bulging tubes.

proper propellant. Such control permits selecting an optimum forming rate compatible with the characteristics and physical properties of the metal to be worked. The forming rates available are far beyond those obtainable on conventional presses and drop-hammers, and are sufficient to shape hard, high-strength materials with a minimum of spring-back.

Normally, all that is required for pressure-forming with propellant type explosives is a closable chamber, a one-piece contour die, the metal blank, and the propellant charge. No supporting equipment is required to fasten down the assembly. Mating dies may be used, but are not generally required.

A typical example of explosive-pressure-forming is seen in Fig. 1. In this setup, an exterior boss is formed on a cylindrical tube. The internal mandrel containing the explosive charge and the external dies are aligned and closed. When the explosive charge is detonated, the pressure generated forms the required boss on the tube. This same basic system is readily adaptable to the forming of various tube and boss configurations, and is versatile enough to permit the forming of bosses on sheet metal.

Explosive-forming can also be done with a hydraulic medium such as water for transmitting the pressure. One example is shown in Fig. 2. Here, a tube is placed in the die, the die closed, and the explosive charge fired. The pressure is transmitted through the water to bulge the tube outward so that it conforms with the contour of the die bore. Another example of explosive-forming under water is illustrated in Fig. 3. In this application, a closed-end tube is explosively expanded to the die contour.

In many cases, the use of rubber as a pressure-transfer medium provides better results than liquids in explosive-forming. Rubber seems to provide maximum forming efficiency with a minimum of wrinkling or spring-back of the part.

Heat generated by the explosion may be rather high (as much as 3200 degrees F.), but the duration is so short that there is not sufficient time for the metal part to be materially affected by it. Pressure-forming with explosives can be safely performed indoors providing the enclosing chamber is adequate to withstand the blast. Normally, it is not necessarily too high a pressure because the rate of application is so high. End products of the explosion are non-toxic, non-corrosive, and not hazardous chemically. When the production requirements warrant the cost, automatic explosion-forming equipment can be set up.

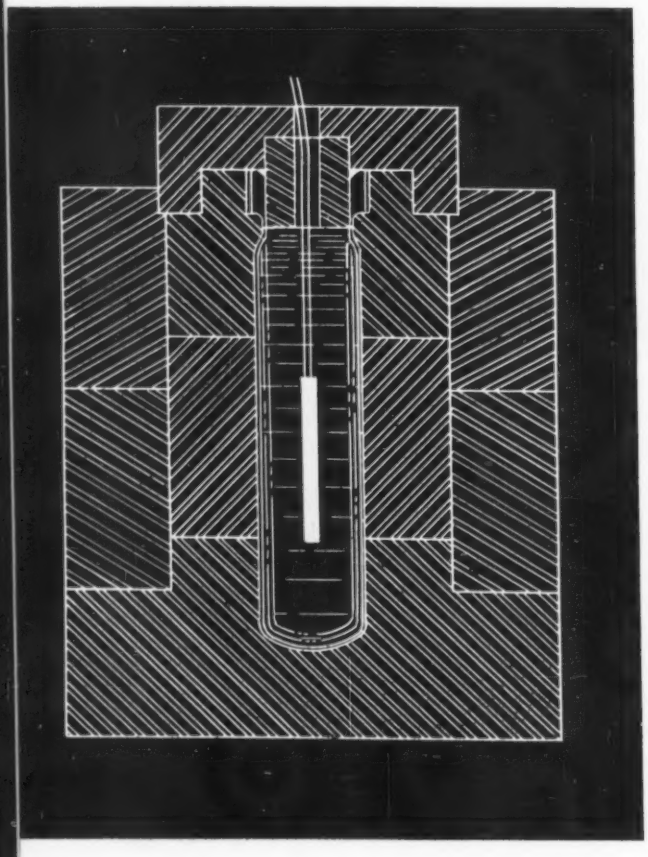
Shock-Forming with High Explosives

While high explosives may be used in a closed system similar to that used with propellants, they are generally employed in an open or semi-open

system, because of their violent nature. Shock-forming with high explosives provides extremely high rates of energy application, and is ideal for shaping hard metal parts that are normally resistant to forming. Also, because it can be used in an open system, very large parts can be formed. For example, the Talco Engineering Co. is now making the tools to explosively form hemispherical titanium components 32 feet in diameter.

The nature of high explosives generally requires that they be used only in remote areas, especially when heavy charges are used. Both noise and shock levels are usually too great for indoor or congested-area use. For high-explosive-forming, all that is necessary is an open die, an explosive charge, and the metal blank to be formed. As shown in Fig. 4, the sheet-metal blank is placed on the open die. When the high-explosive charge is fired, the shock wave and pressure form the blank to the contour of the die.

Dies for high-explosive-forming may be cast from metal, epoxy resin, or ceramics, or a combination of these materials. Large dies can be made at relatively low cost in a short time. This makes the process especially adaptable to experimental work or the production of work-pieces where only limited quantities are required.



Explosive-forming may be used for:

1. Complete forming in one operation. Heat-treated flat stock is being formed in this way.

2. Final forming of preformed or prefabricated parts, which, in some cases, are also heat-treated.

3. Progressive-forming, starting with soft stock and successively forming to the final, heat-treated part.

4. Forming of heated metal blanks. This method is particularly suitable for forming metals such as beryllium, having critical hot-working characteristics, because the die does not touch the blank until it approaches final form. Even then, the forming rate is higher than the rate of heat flow so that the temperature of the work-piece is not changed appreciably until it reaches the final required configuration.

The rate at which shock-forming is accomplished can be controlled somewhat by the selection of explosives, but forming is completed in a matter of microseconds. Explosives are available in powder, liquid, block, sheet, pellet, rod, or cord form, and may be tailored for specific applications. By proper tailoring and placement of the explosive, shock-forming can be performed on localized areas of the work-piece.

Venting or evacuation of the air between the blank to be formed and the die is a problem that must be solved according to the specific situation. Lubrication, if required, is normally confined to dry types.

Explosive-forming is not confined to sheet stock. The magnitude of the energy available and the extremely high rate of application make possible impact loading suitable for cold extrusion, swaging, and forging. Since there are no limitations imposed by the machinery or building space required, a large range of part sizes can be produced.

Advantages and Limitations

Among the advantages of the explosive-forming process are:

1. A single-unit contour die is normally all that is required—thus minimizing die costs, preparation time, and setup.

2. The pressure cycle is so short that the die may be made of castable materials such as cast iron, epoxy resins, ceramics, or low-melting-point alloys like Kirksite.

Fig. 3. A closed-end tube is expanded to contour of die in this underwater explosive-forming operation.

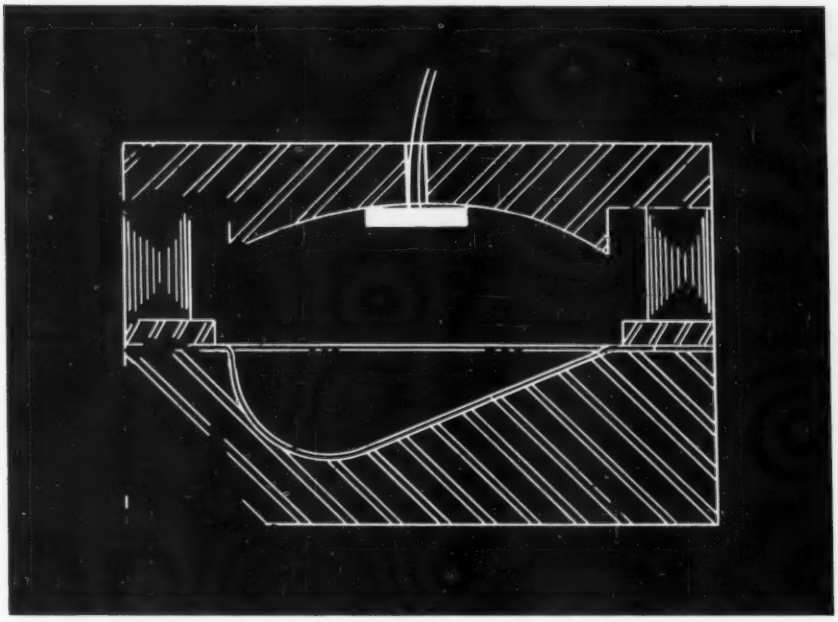


Fig. 4. An open die is used for this high-explosive-forming operation. Shock wave and pressure form blank to the die contour.

3. The magnitude of the energy available and the high rate of application permit working metals that cannot be formed conventionally.

4. Cost of forming is at a minimum because no machinery, building, or utility facilities are required.

5. Extremely large parts may be formed.

6. Hot-forming is possible because of the short cycle time before the final shape is obtained.

7. Speed is sufficiently fast to permit forming some heat-treated materials without appreciable change of hardness. Also, hardening due to cold-working is minimized.

8. Because no punch is required, localized friction and metal thinning at angular surfaces and rounded corners are considerably reduced. The metal is pushed multi-directionally over the contour die, with metal-to-die contact only on the die side of the part being formed.

9. Because fully heat-treated stock can be formed, more accurate dimensions can be held on precisely contoured parts than with conventional forming of soft metals followed by heat-treatment, with its consequent warpage, shrinkage, or expansion.

Among the disadvantages of the explosive-forming process are:

1. The limits to which metals can be formed depend on the physical properties of the metals.

2. The process is not competitive when the parts can be produced in large quantities on conventional equipment.

3. Open-die explosive-forming cannot be done in congested, enclosed areas.

4. The use and storage of high explosives are prohibitive in most industrial plants or areas. Open, remotely located areas are generally required. However, propellant type explosives can usually be stored and used in many plants, since such materials will burn but not detonate.

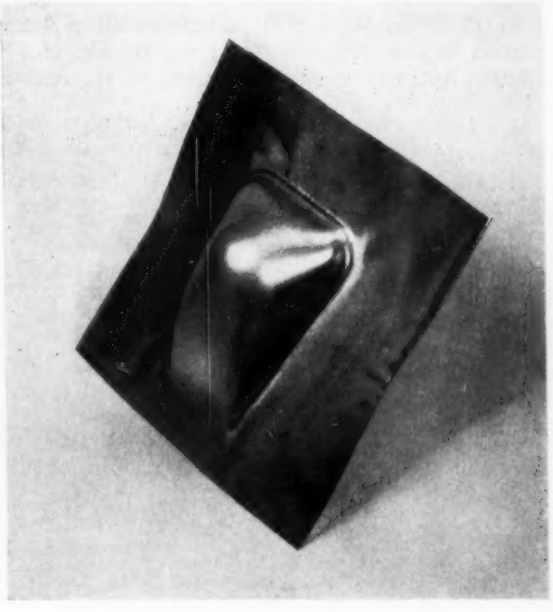


Fig. 5. Deep-drawn part explosively formed from 0.050-inch-thick aluminum alloy at Ryan.

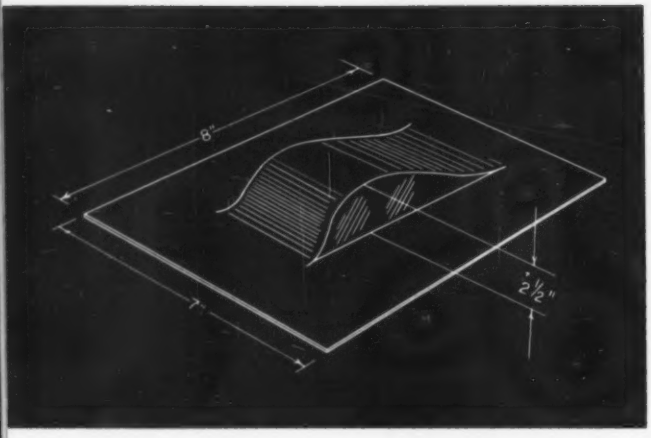


Fig. 6. Dimensions of the part shown in Fig. 5. Explosive-forming is completed in two stages.

Current Status of the Process

A recent cross-country survey of explosive-forming applications by the author disclosed that, as far as could be ascertained, no company has done any significant amount of actual production by this method. Study and experimentation, however, has been in progress for several years. Some defense contracts have been initiated for research and development. Also, some companies have been engaged in experimental work and exploratory forming, while others have produced limited quantities of production parts in this way. The Manufacturing Methods Division, Basic Industry Branch, Air Materiel Command, U. S. Air Force, has accomplished considerable research and experimental work with the process.

A typical part that was deep-drawn by means of explosives at the Ryan Aeronautical Co., San Diego, Calif., is seen in Fig. 5. This part, made from 0.050-inch-thick, 6061 aluminum alloy, was formed in two stages without the benefit of a solution heat-treatment. Dimensions of the completed work-piece are given in Fig. 6. Another part explosively formed at Ryan is seen at the left in Fig. 7, with the truncated cone from which it is formed at the right.

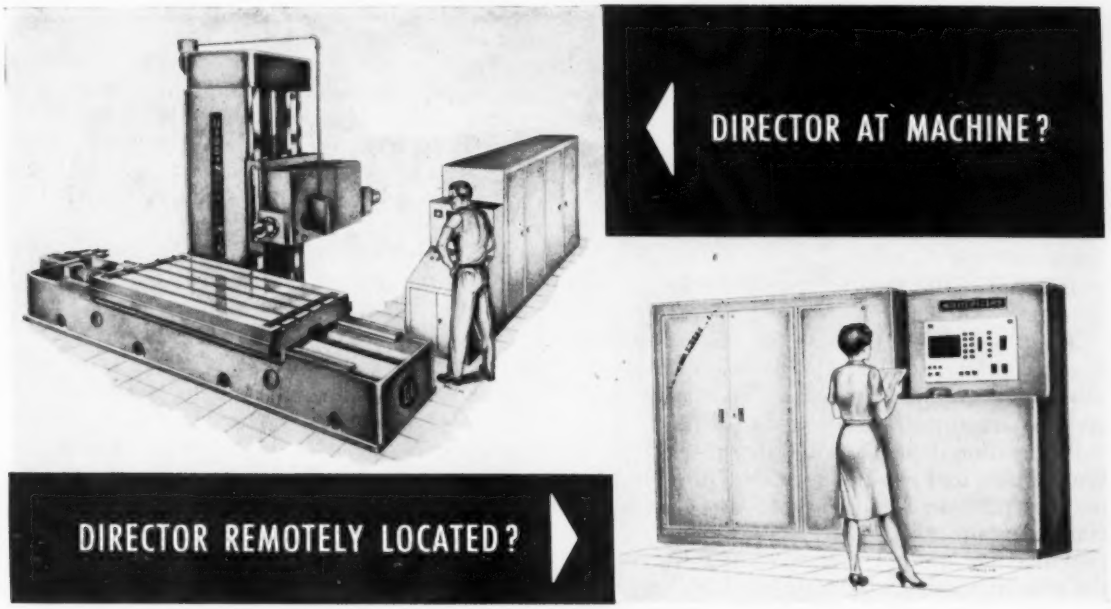
The Talco Engineering Co. is setting up a Division at Falcon Field, Mesa, Ariz., that will be dedicated exclusively to the development of explosive-forming production facilities. The company can provide complete production of finished parts, including research and development, tools, dies, testing, materials, fabrication, and inspection. Also, they can explosively form parts with the customer's tools, or provide tooling.

Future Requirements

Progress of explosive-forming will require:

1. New concepts in tool and die engineering, with special emphasis on the use of castable materials suitable for making large-area parts. A typical die might be made of an epoxy-resin liner backed with fiber-glass laminates, cast in a reinforced ceramic body and base.
2. The establishment of limits to which specific metals may be formed by the process.
3. Determination of optimum forming rates for specific materials.
4. Development of efficient means of evacuating the air from between the blank and the die.
5. Development of explosives more adaptable to metal-forming than those now available.
6. Selection of parts appropriate for production by explosive-forming.
7. Careful recording and documentation of all data established as the program progresses.

Fig. 7. Part at left is explosively formed from a truncated cone (right) at the Ryan Aeronautical Co.



Economic Considerations in Purchasing

NUMERICALLY CONTROLLED MACHINE TOOLS

JESSE DAUGHERTY
Staff Vice-President—Engineering
Giddings & Lewis Machine Tool Co.
Fond du Lac, Wis.

TAPE CONTROLS have progressed from the point where they were merely a new, exciting method of controlling machine tools offering possibilities in improved accuracies and finishes to their current status where they are being considered for specific applications of all types. Their acceptance or rejection now rests on many of the same factors that are considered in making any major capital-goods investment.

Actual machine-shop experience has confirmed machine manufacturers' claims that almost any three-dimensional part can be produced in from one-third to one-fourth the previous floor-to-floor time. Even tool and die shops engaged in producing only one or two parts at a time have proved the values inherent in this method of machine control.

Admittedly, the investment is large enough that it is not taken lightly. Various systems are in operation for which the initial investment in machines and controls is different. As a result, there is considerable confusion in the minds of potential buyers as to which path to follow. The cost of operation also varies with the particular system. A setup which is selected to suit a particular product offers significant savings in manufacturing cost. Much of the problem centers about whether it is better to have the interpolating director at the machine tool (in a machine-interpolated system) or to have a separate, remotely located director with a magnetic-tape link (in a remote-interpolated system). Each system has factors in its favor. The purpose of this evaluation is to examine all of these factors so that the best decision can be made for each installation.

Elements of Tape Control

First of all, it would be helpful to review the elements in each type of system and the part they play in the over-all installation. The initial methods study to determine the order of cuts, cutting speeds, feed rates, tooling, etc., is common to all systems. Also, the preparation of a manuscript carrying this information in shorthand form and the conversion of the information to punched cards or tape is comparable for all systems now in use.

The processing of the data through a computer is also similar, and the required information usually appears on punched cards. To this stage, all systems are similar, and the cost of investment and operation depends primarily on the production volume and equipment used. However, it is not the purpose of this article to evaluate the computing process.

When the interpolating director is located at the machine (machine-interpolated system), signals coming from the punched tape are first interpolated and then transmitted by electrical circuits directly to the machine control. No magnetic tape, tape recorder, or tape playback is required.

When the interpolating director is remotely located, signals initiated by the punched tape are interpolated and then fed into a magnetic-tape recorder. The magnetic tape that is produced is delivered to the machine and used to operate the machine through a tape playback interconnected with the machine console.

The term "interpolation" applies to the conversion of the digital, incremental information carried on the paper tape to coordinated analog information suitable for controlling the servo motors which drive the machine slides. The interpolation function exists in all numerical-control systems in approximately the same form. It is a data-conversion function usually performed electrically with computer type circuitry and its cost is about the same for various systems—about $50,000 for a three-axis system.

Servicing One Machine

When only one machine is to be purchased, the machine-interpolated system requires a smaller initial capital investment because the tape recorder and tape playback are not necessary. This fact also holds true to a somewhat lesser extent when two machines utilizing tape control are installed. As shown in Fig. 1, it is economically advantageous to use a remotely controlled director when three or more machines are installed. This is evident from the fact that one interpolation system serves a number of machines.

Actually, the prospective buyer of tape-controlled machine tools has two compromise solutions—both of which fall between the two extremes of remote-interpolated and machine-interpolated systems. One solution is to purchase a machine-interpolated system with the provision for converting to a remote-interpolated system when a second magnetic-tape-controlled machine is re-

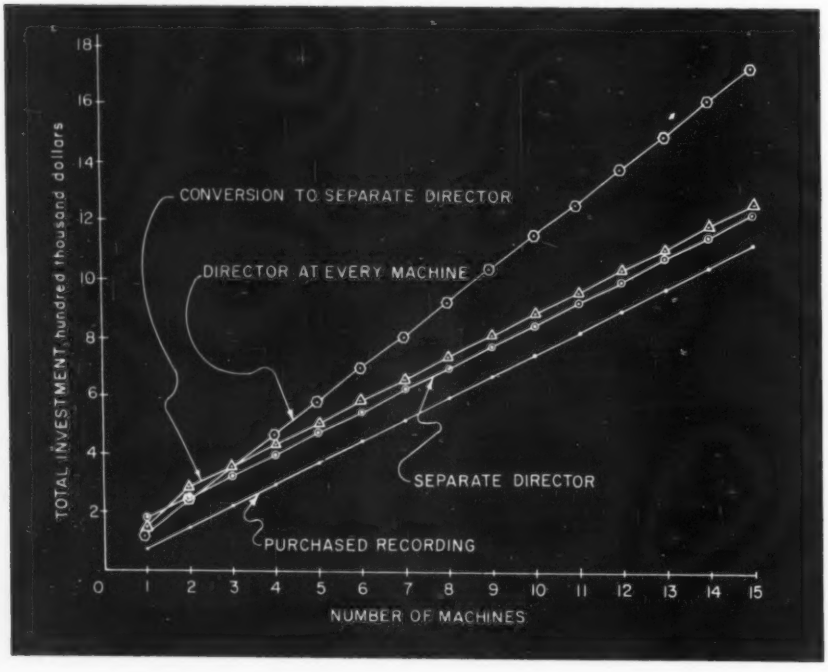


Fig. 1. Total original investment in various control systems for different numbers of machine tools.

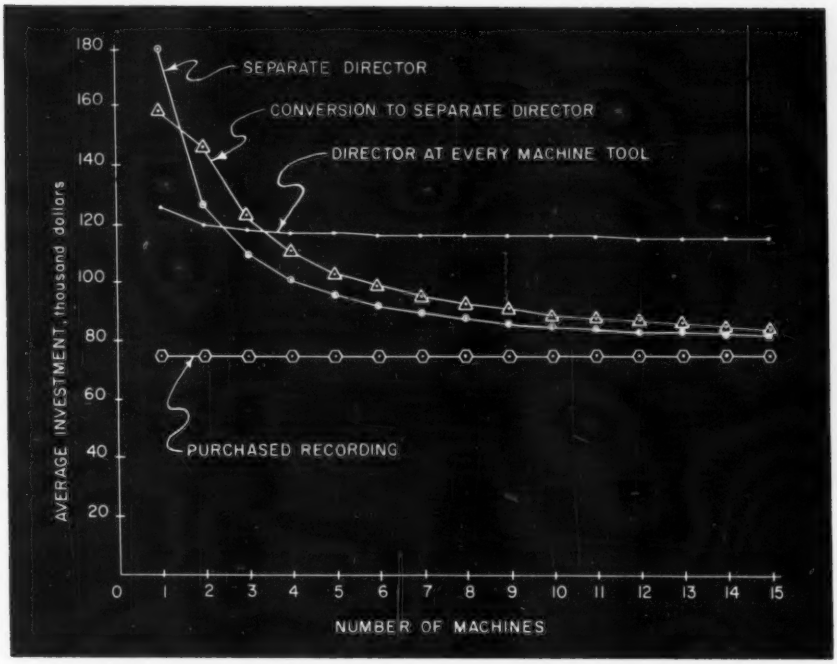


Fig. 2. Average investment required in various control systems for different numbers of machine tools.

quired. It should be pointed out, however, that the cost of making this conversion has to be added to the total investment, resulting in the greatest capital outlay of any system for two machines. With three machines, the investment approximately equals the wholly machine-interpolated system and thereafter shows a decreased cost per machine.

The second compromise permits the lowest level of initial investment of any system. Quite simply, the user of the tape-controlled machine does not purchase an interpolating director. All the required tapes are purchased from one of many commercial sources currently available. The paper-tape programs used to make up the magnetic tapes are produced by the machine user who is familiar with the manufacturing operation. With this solution, the machine tools in a particular plant are charged with only their fair share of the interpolating-director overhead.

Present-day directors are capable of providing tapes for a minimum of four machines, even when used for only one shift and on a one-per-lot basis. Actually, the number of machines that can be handled by a single director is much higher because the magnetic tape, once produced, is generally used repeatedly to turn out a number of pieces. In cases where multiple parts are produced, a single director may serve up to fifty machines.

When an outside recording center or service is used, an additional cost is incurred in the transfer of data and tapes to and from this facility. Since this cost depends to a large extent on the distance between the user and the recording center, no attempt has been made to evaluate it in this discussion.

A graphic representation of the relationships of fixed charges that each machine must bear with the several choices of control locations is shown in Fig. 2. It should be noted that what is being charted here is merely the average investment in available control systems versus the number of machines.

Cost per Hour of Operation

The most important consideration in comparing the two systems is the relative cost per hour. Two illustrations of costs for these two systems are shown in Figs. 3 and 4. These charts compare first-year and third-year costs. If we assume the same machine feed rate for all examples, cost per hour is an almost direct indication of part cost.

As might be expected when only one machine is involved, location of the interpolating director at the machine gives the lowest cost. It is worth noting, however, that with only two machines a separate director results in savings even though the recording unit is utilized as few as fifty hours per year. The savings are even larger when more machines are used. If the director can be used for recording at a profit during the balance of the available time, the remote-interpolated system widens its lead over the machine-interpolated system even more.

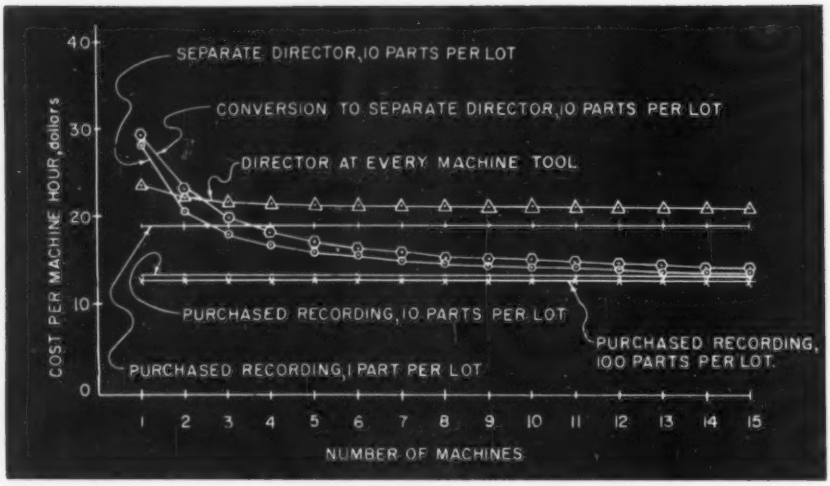

SEPARATE DIRECTOR, 10 PARTS PER LOT
CONVERSION TO SEPARATE DIRECTOR, 10 PARTS PER LOT
DIRECTOR AT EVERY MACHINE TOOL
PURCHASED RECORDING, 10 PARTS PER LOT
PURCHASED RECORDING, 100 PARTS PER LOT
PURCHASED RECORDING, 1 PART PER LOT
COST PER MACHINE HOUR, dollars
NUMBER OF MACHINES
0
10
20
30
40
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15

Fig. 3. First-year cost per machine-hour of the two control systems for different numbers of machines.

In drawing these curves, certain assumptions have been made that may not be true in every instance. Perforated-tape cost, for example, is a small item, and is assumed to be the same for the two systems. If only one part per lot is produced, this assumption would hold true. Where lots are greater, it becomes increasingly less accurate. In such cases, the cost is lower for the remote-interpolated system because the perforated tape wears with repetitive use. In a magnetic system, the perforated tape would be run only one time to produce the magnetic tape which would be cycled repeatedly during the manufacturing operation.

Another assumption was that sixteen magnetic tapes would be required for each machine in a remote-interpolated system. When considering one, two, or three machines, this estimate is reasonable. Where more machines are used, this assumption is less valid. Here again, the remote-interpolated system would show up better if more correct estimates were possible. Unfortunately, there is insufficient field data to permit reliable figures based on actual in-plant operations of large numbers of machines.

Advantages of Remote Director Operation

Available machine times that have been charted are based on one-shift operation and on actual in-plant experience with the two systems. For example, it has been found that the director functions best in a remote location offering a clean environment. Maintenance is less frequent and more easily handled in such cases. Even more important, perhaps, is the increased utilization of the machine tool itself with the operating ratio increasing from a range of 75 to 80 per cent to a range of 88 to 93 per cent. Obviously, costs per hour are materially affected by an increase in the operating ratio.

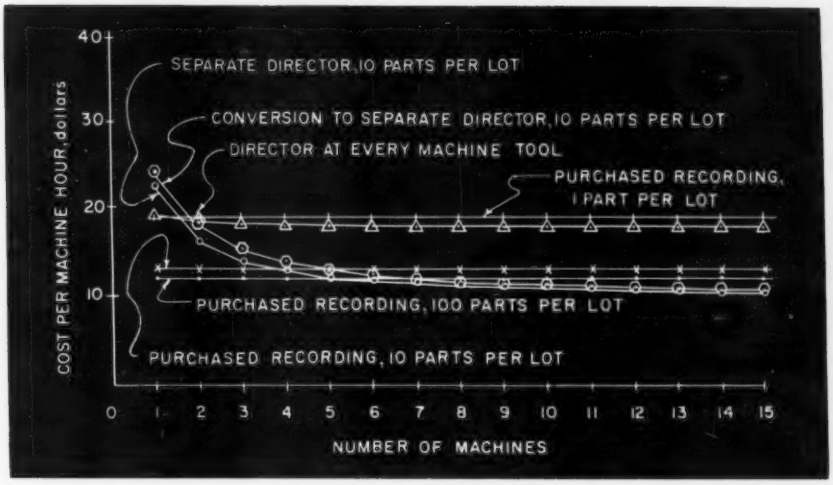
Another extremely important point is the assumption that no lot would be used more than once. This assumption was made to simplify plotting. If lots are repeated at a later date, the remote-interpolated system would show additional benefits. Actually, re-use of tapes is extremely reasonable since magnetic tape provides major operating advantages in intermittent production. This factor is important in many machine purchases. If operations are repeated, recording costs are absorbed by the greater number of parts produced, thus extending the benefits of the remote-interpolated system installation even further.

Conclusions Based on Facts

Having weighed the various factors that determine the best method of selecting numerical-control systems, some practical conclusions can be stated. It has been shown that the use of outside tape-recording sources provides a distinct advantage for one or two machines, even if charges at the highest known rates are assumed. These advantages are most apparent during the first year of operation.

Machine-hour costs for runs of ten parts per lot are about two-thirds those for a machine-interpolated facility having one machine. The advantage of purchased recordings over machine-interpolated systems is maintained for more than one part per lot, although the graph shows that the advantage increases toward a definite limit as the number of parts per lot increases.

As the number of machines increases, it becomes more attractive to have a separate director as compared with outside recording. In the third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DIRECTOR AT EVERY MACHINE TOOL
PURCHASED RECORDING, 1 PART PER LOT
PURCHASED RECORDING, 100 PARTS PER LOT
PURCHASED RECORDING, 10 PARTS PER LOT
COST PER MACHINE HOUR, dollars
NUMBER OF MACHINES
40
30
20
10
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15

Fig. 4. Third-year cost per machine-hour of the two control systems for different numbers of machines.

year, for example, Fig. 4 shows that the costs with five machines are comparable with those of purchased recordings for 100 parts per lot.

An installation requiring conversion some time after the original machine purchase shows a disadvantage compared with the cost of an installation having a separate director. Two factors are worth noting—fewer operating hours are reflected in the operating costs for a single machine, and the cost of conversion is significant in the operating costs for two or more machines. Though the disadvantages of a compromise requiring this change-over are obvious, a cost advantage is gained over the system having interpolation at the machine when two or more machines are considered.

With the remote-interpolated system, cost per machine-hour decreases as the number of parts per lot increases, as shown in Fig. 5. These figures are based on a saturated (one-shift basis) director. The advantages of dividing the expense of director operation over a number of machine tools are readily apparent. The remote-interpolated system would actually appear even better in most installations because this evaluation assumes that no recording is used for a second production run.

Thus, it becomes apparent that the remote-interpolated system provides material advantages for both large and small shops. The small shop generally should buy its recordings from a commercial source until such time as production deadlines or an increased number of tape-controlled machines make it economical to provide its own interpolating director. Purchase of recordings enables the small shop to take immediate advantage of the most modern developments in numerical control with a smaller initial capital investment.

Companies using a larger number of numerically controlled machine tools find the remote-interpolated system far more economical in the long run. A knowledge of all these factors is the best guide to making a sound decision that combines optimum operating conditions with the lowest over-all capital investment.

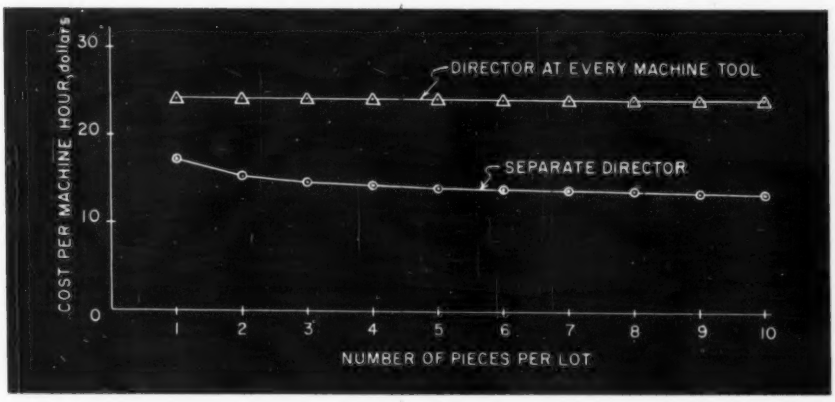

Fig. 5. Cost per machine-hour of various lot sizes for a separate director and a director at every machine tool.

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Brown & Sharpe Mfg. Co.
Providence, R. I.

Gearing for High Gear Production

TO STREAMLINE PRODUCTION of its new automatic screw machine, Brown & Sharpe Mfg. Co. has established a self-contained division in which, as far as is practicable, all parts for these machines are made. Equipment for the new division is installed in eight production lines, with separate lines set up for completing turned parts and gears, milled parts, ways and cross-slides, spindles, turret-slides, beds, bases, and drive-shaft brackets. The object of the new arrangement is to speed production, lower manufacturing cost, and minimize in-process handling.

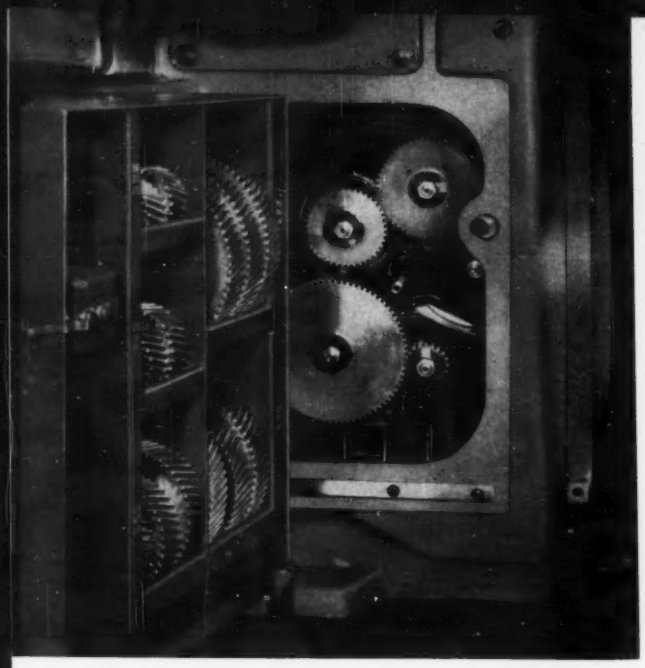
The gear-making operation particularly illustrates the production and handling methods employed. Over seventy individual gears and sprockets are required for each Brown & Sharpe automatic screw machine. Typical of these are the spindle change-gears illustrated in Fig. 1. These are 12-pitch, helical cut gears having from nineteen to seventy-six teeth. A set of eighteen is furnished with each machine. Manufacturing cost of the gears has been reduced 45 per cent and the in-process time one-third, by using the new equipment and layout. In addition, 80 per cent of in-plant handling has been eliminated.

Spindle change-gears were formerly moved to ten levels located in five different buildings for completion of the necessary operations. Now, the gears are completed in a single building and moved only once between floors. Prescribed quality standards for all operations are maintained by roving inspectors, under the direction of a quality-control department.

In producing spindle gears, the stock is first cut off and delivered to the 10-inch, twelve-spindle Bullard Mult-Au-Matic vertical chucking machine shown in Fig. 2. This machine, equipped with two spindles per station, has five working stations and one loading station. The work-piece is indexed around the machine twice, once for machining each side of the blank. After every indexing, the operator inverts and transfers one piece from the first to the second chucking and loads a rough piece of stock for the first chucking. The finished blanks are then stamped to indicate number of teeth, and placed on trucks to convey them through the balance of the operations.

To minimize change-over time, gears are ordered in minimum lots of 200 pieces and in size sequence. For each size change, the only tools necessary to reset are those for turning the periphery and cutting chamfers. The tools used to face the sides are relocated only twice in machining gears in the entire size range. Tool-holders with indexable type inserts allow the replacement of worn cutting edges without resetting. With this equipment the cost of the blank turning has been reduced 75 per cent.

Rough broaching of the six-spline hole in each gear is the next operation. This is done in a 25-ton, horizontal broaching machine which pulls the tool through the hole at a speed of 12 feet per minute. The hole is then ground to an intermediate size in preparation for gear cutting. Semi-automatic Heald internal grinding machines are



used, equipped with special, air-operated finger chucks. The chuck (Fig. 3) has a retractable plug that centers the spline within the desired limits.

After the splined holes are ground, the blanks are loaded three at a time on work-arbors that, in turn, are placed into the headstock spindles of the Michigan Tool gear-hobbers seen in the heading illustration. A number 30 taper locates the arbor in the spindle.

When the start button is pushed the machine automatically cycles. First, the tailstock center moves into place under hydraulic pressure which is continuously maintained during the entire cycle. Both the hob and work-spindle then start rotating. The hob is plunge-fed to the proper depth and the work immediately starts to traverse the hob. When the hobbing is completed the hob spindle retracts and the machine members return to loading position. The operator removes the work-arbor in the machine (Fig. 4) and interchanges it with one he has loaded while the cycle was in progress. The process is then repeated. Hobbed gears are deburred in an Osborn Brushamatic machine (Fig. 5) equipped with a 14-inch diameter, 0.0118-inch wire size Tufmatic brush.

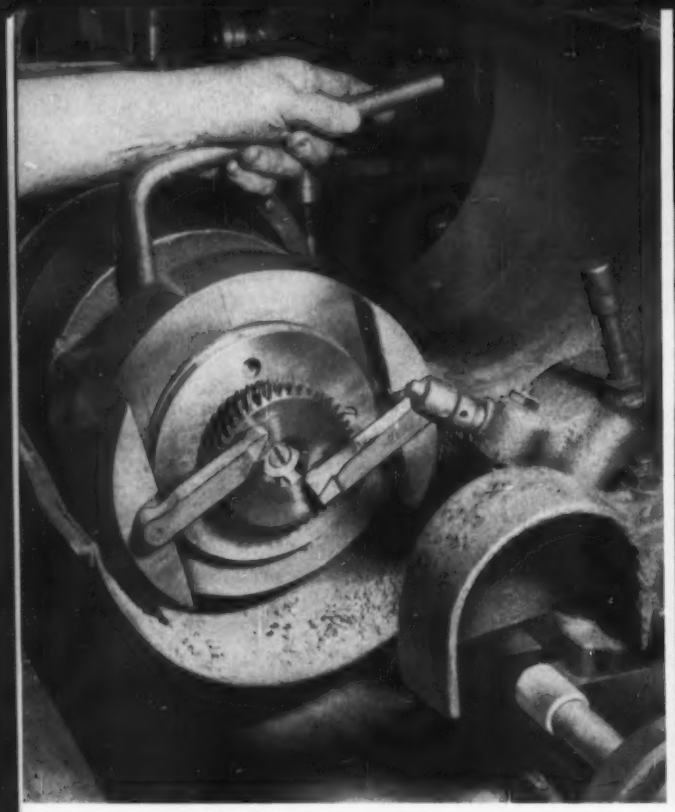
Next, the gear teeth are finished in a Michigan Tool gear shaver. As in hobbing, the operator loads one arbor while the other is in the machine. For shaving, however, only one gear is placed on the arbor at a time. In both operations, an air-operated wrench is suspended overhead to facilitate arbor loading. The arbor is simply dropped into a fixture, the air wrench is brought down, and the clamping nut is either removed or tightened. In Fig. 6, a gear, mounted on an arbor, is seen being placed into the machine for shaving.

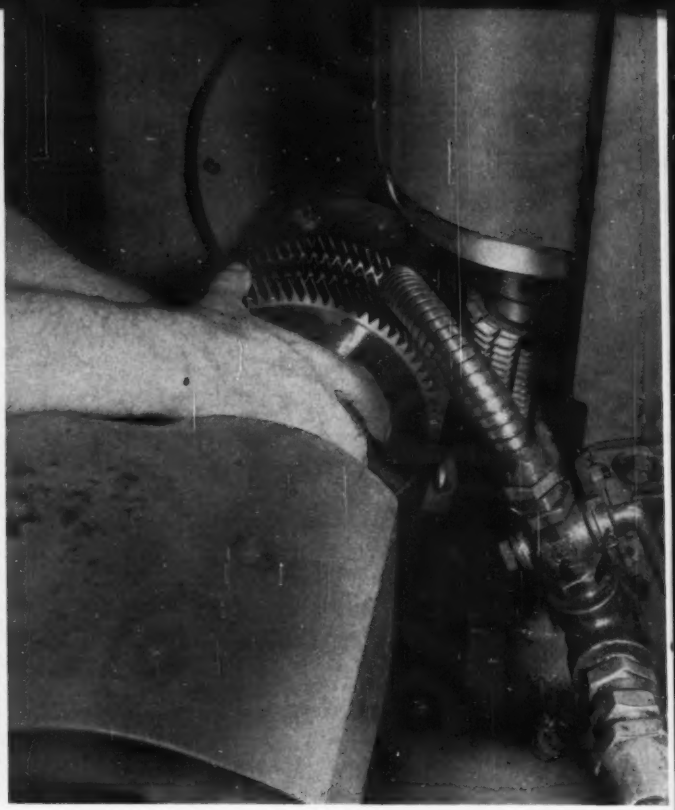
One gear of each pair is crown-shaved to prevent edge-loading of the gear teeth due to distortion during heat-treatment, slight errors in mounting alignment, or shaft deflections under operating loads. Edge-loading of the teeth can cause chipping. These hobbing and shaving operations have produced uniform, accurate gears and have reduced the cost of gear cutting by 60 per cent.

Before being hardened, the gears are cleaned in a Detrex solvent degreaser. For this operation they are loaded twenty to thirty at a time in a basket and moved manually onto a carrier within the degreaser. After the semi-automatic cycle is started, the carrier moves clockwise through three stations 90 degrees apart. The carrier stops at each station for a predetermined time (thirty seconds for the spindle change-gears) before returning to the starting position. On removal of

Fig. 1. (Above) Spindle change-gears used in a Brown & Sharpe automatic screw machine. Over seventy gears and sprockets are required for each machine.

Fig. 2. (Right) Blanks for spindle change-gears are machined in this vertical chucking machine in two chuckings. Operator is seen inverting and shifting the work-piece for the second chucking.





the gears from the degreaser—while they are still warm—a water-soluble flux is applied to the teeth and adjacent areas. This is done by rolling the gears through a pan containing Kwikflux No. 95 to a depth of approximately 1 inch. The flux, made by the Special Chemical Corporation, is used to prevent fire scale and oxidation during hardening and thereby preserves the finish of the teeth.

Hardening is accomplished in a "Ther-monic" induction machine having a work station equipped with two spindles set in a "sink," Fig. 7. This unit was specifically designed to allow different heats to be applied to work on each spindle through the use of a built-in, thyratron output power control. Quenching is done with controlled-temperature water, using quench rings designed for a given range of gear sizes.

In operation, the work-piece is placed on a spindle and a push-button is pressed. This lowers the spindle into position for hardening, turns on the power, and starts the spindle rotating. After

Fig. 3. (Above, left) Hardened gear blank is shown held in a special finger chuck for internal grinding. A spline centering plug is being retracted prior to finish grinding of the splined hole.

Fig. 4. (Above, right) Three gears supported on arbor are being removed from gear-hobber. Operator loads a second arbor while gears are hobbed. Machine cycle is automatic.

Fig. 5. (Left) The spindle change-gears are deburred in this power-brushing machine. Wheel is 14 inches in diameter and brush material is 0.0118-inch-size wire.

Fig. 6. Here operator is seen removing a finished spindle gear from a gear-shaving machine. Cutter is directly below work gear. One gear of each pair is crown-shaved to prevent chipping of teeth.

a predetermined time, the power is shut off automatically and the quenching cycle started. Flux is washed away by the quenching water. The spindle then stops and elevates to the loading position. As the gears are removed from the spindle, the operator places them into baskets mounted on dollies for transfer to Leeds & Northrup Steam Homo tempering furnaces. In this equipment, the gears are heat-treated in an atmosphere of steam to eliminate the formation of scale. The tempered gears have a thin film of blue-black oxide—a desirable finish with an affinity for oil.

Directly after heat-treating, while still warm, the gears are dipped in oil and loaded on trucks for return to the internal grinding machines. There the rough-splined holes are ground (Fig. 3) to the finished minor diameter of the spline. Finish broaching of the six spline holes is the final machining operation, the broach being located by the surfaces previously ground.

Hand finishing consists of burring the splines, stamping the number of teeth on the second side, and checking the teeth by rolling the gear in mesh with a master. Any burrs or nicks made apparent with this check are removed. The gears are then packaged and marked, and forwarded to an accumulation area where various loose parts are boxed in sets for shipment with the machines. Other parts processed in these lines are handled in a similar manner. On completion, however, they are delivered directly from the manufacturing areas to designated stations along the various assembly lines.

Fig. 7. Gear is placed on one of two vertical spindles for induction hardening. Controlled-temperature water is applied to the part through special quench rings.

Cutting and Welding Methods Enable Building of Aluminum Trucks

GIANT aluminum dump-truck bodies, believed to be the largest of their kind in the world, are rolling off a production line at the Heil Co., Milwaukee, Wis. The aluminum components of these trucks are produced by the Heliarc cutting process. Other methods of cutting the aluminum parts would have been too expensive to make the unit practical, according to the firm's engineers. The components are fabricated into truck bodies by Sigma (shielded inert-gas metal-arc) welding.

Built for the Aluminum Company of America, these 27-ton trucks will haul bauxite from mountain mines in the Dominican Republic to Caribbean ore boats. Dumper floors of the trucks are heated by engine gasses to speed removal of the moist, sticky bauxite. The trucks have a capacity

Fig. 1. Key to the production of the huge aluminum trucks is this Heliarc cutting machine which severs 3/8-inch aluminum plate at a rate of 60 inches per minute.

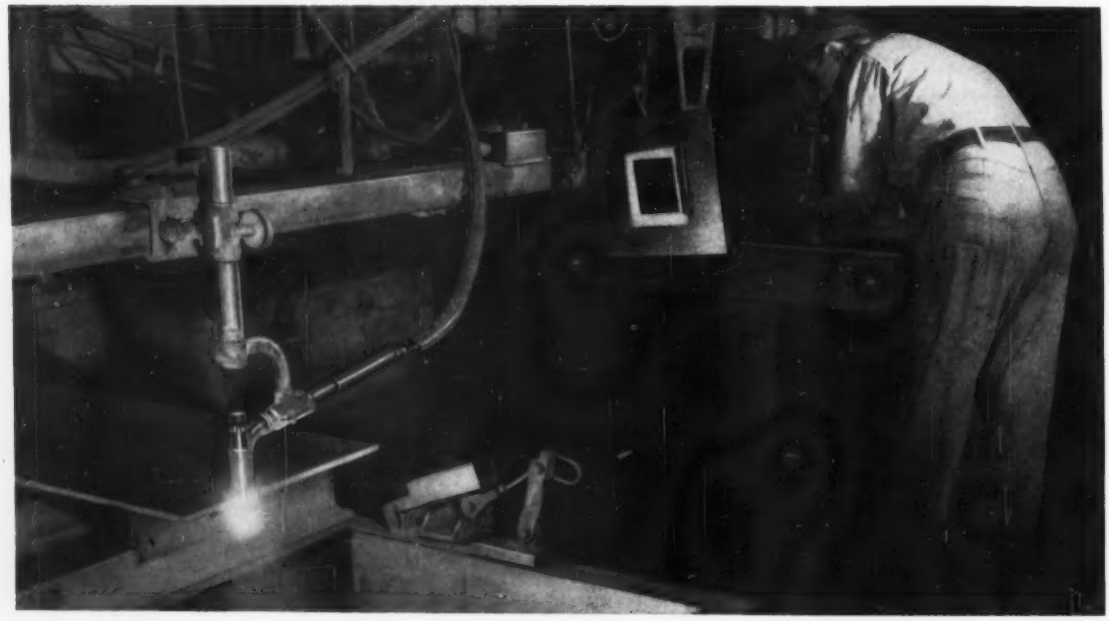


Fig. 2. Side bolsters are attached to the dump bed in three passes with this mobile, semi-automatic Sigma Welding equipment. Cart at the left holds control unit, argon cylinder, and water supply.

of 37 1/2 cubic yards and weigh 11,000 pounds less than steel trucks, adding a similar amount to the payload.

Over 5000 linear feet of Heliarc cutting and 20,000 linear feet of Sigma welding are required to build each truck.

Both plate and extruded sections of Alcoa type 5454 high-tensile aluminum alloy are used. The majority of the components are 3/8 inch thick but many range up to 3 inches in thickness.

Cutting operations are performed by the machine shown in Fig. 1 which has a Heliarc FSH-5 cutting torch mounted on a carriage that is accurately guided by a template. Plate 3/8 inch thick is cut at a rate of 60 inches per minute. The aluminum parts are then joined by mechanized and manual Sigma welding operations to form the various sub-assemblies that make up the main body.

To fabricate side bolsters for the body, use is made of a fully automatic Sigma machine which has a torch mounted on a carriage (Fig. 2). The truck bolster consists of two formed parts which are butt-welded in two passes.

Semi-automatic Sigma welding equipment is used to join the bolster to the side of the truck body. The welding units are completely mobile, with water-supply tanks, controls, and argon cylinders mounted on carts that are easily moved into position near the work.

Combined Casting Processes Overcome Parting-Line Limitations

Combining plaster-mold and investment-casting techniques has greatly increased design possibilities for precision castings produced by the Atlantic Casting & Engineering Co., Clifton, N. J.

In normal plaster-mold casting procedure, production molds are formed in two sections on brass patterns. Each section must be removed from the pattern intact. All castings must be capable of being divided along a parting line, so that neither section contains "uncoreable" undercuts.

In the new technique, areas that cannot be withdrawn are cast in wax or plastic and attached to the withdrawable brass patterns. After the mold plaster sets, the brass patterns are removed, leaving the wax or plastic imbedded in proper position. When the resulting mold is dried, the imbedded wax or plastic is vaporized, leaving an accurate cavity as part of the space which forms the finished casting.

Since the drying cycle is a normal part of the plaster-mold process, no time is lost in vaporizing the imbedded wax or plastic. Many castings can now be produced that were either impossible or too expensive to produce by the usual cope and drag techniques when cores were employed.

Polaroid Camera Furnishes Progress Report on Machine Construction

ONE OF NEW ENGLAND'S largest machine tool manufacturing companies is using on-the-spot photography to keep its customers abreast of the progress being made on equipment under construction.

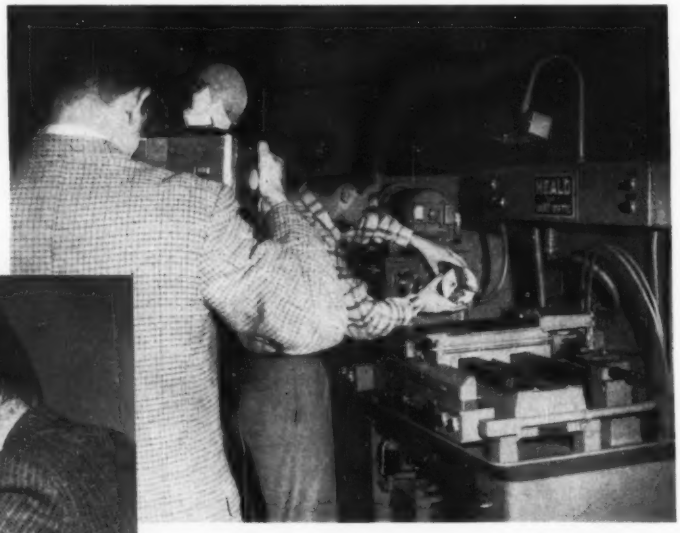
When a customer's representative visits the Heald Machine Co., in Worcester, Mass., to inspect a machine being built for his firm, the plant photographer takes four to five pictures of the unit with a Polaroid Land camera—the camera that produces a finished print in only a minute.

Photos of the completed units and sub-assemblies are handed to the representative for his progress report to the home office, outlining the status of the machine at the time of his visit. As a result of the service, customer goodwill toward the Worcester firm has been increasing.

"When we hand a representative pictures which he has seen taken just a couple of minutes earlier, it's a definite goodwill booster," states E. J. Keyes, Heald vice-president and works manager. "For one thing, he's pleased because the photos make his job of reporting to the home office on what he's seen a lot easier. The people at the home office are pleased too, because they have a better understanding of the progress we've made on the machine—and they know the pictures are right up-to-date."

To stress this point, the Heald photographer frequently snaps a photo of the representative examining the machine, and includes the finished print as part of the picture series. "When our customer looks over the pictures of his machine and comes across one showing his field man standing beside it, there can be no question that the photographs are an up-to-the-minute record," Keyes contends. Almost 600 of these photos are being taken each year.

At one time, Heald's sales engineers simply brought the customers' representatives into the plant and let them examine the machines. Frequently, the field men would spend ten or fifteen



(Right) While a machinist puts a new Bore-Matic through its paces before delivery, the plant photographer provides graphic proof of the activity for the customer.

(Left) One minute later, Heald sales engineer points out details of the new machine to customer's representative for a progress report to his home office.

minutes taking notes or making rough pencil sketches so they could better explain to their superiors what the machines looked like. The company then started using cameras, conventional ones, to make photo progress reports, but ran into a snag because of the time required to process film and make enlargements.

It was almost impossible to shoot pictures when a representative arrived at the plant, and still present him with finished prints before he left thirty minutes to an hour later. In most instances, the prints had to be mailed to him. They were usually about a week old by the time the home office saw them.

Under the present setup with the Polaroid camera, this time-lag problem has, of course, been solved. The representative not only watches the photos being taken; he leaves the plant carrying the finished prints. The plant photographer usually snaps both full-view pictures of the machine and close-up shots of various parts. In less than ten minutes, he can hand the field man the whole series of postcard-size photos.

Heald has also found other applications for on-the-spot photography. The research and development departments photograph prototypes of new machines and distribute prints to company engineers as an aid in studying revisions and modifications. The pictures are filed with spec sheets for future reference. The Polaroid camera is also used to take last-minute photos for the company's house organ, and file pictures of employes enrolled in its extensive on-the-job training program.

"Dip Transfer" Shielded-Arc Welding

A new "Dip Transfer" process that facilitates welding of mild and low-alloy steel by a metal arc shielded in a CO_2 atmosphere has been announced by Air Reduction Co., Inc. Metal is transferred entirely by a wiping action at the time of short circuit, rather than by projection through an arc stream. The short circuits, caused by the electrode dipping into the weld pool, occur at a very steady rate, as high as 200 contacts per second. The result is a pulsing arc rather than an open, stable arc. The arc voltage is relatively low.

The moving electrode first comes in contact with the pool, creating a short-circuit load on the power supply, which causes the current to surge upward toward a very high value. However, before this electrical surge reaches its maximum peak, overheating is caused by resistance to the flow of current at the point where the electrode enters the weld pool. Surface tension causes the metal to be wiped off the electrode and shortly thereafter—with an assist from electromagnetic pinch effect—the contact is broken and a relatively high-current arc is established. This sequence results in metal transfer without spatter.

Energy from the arc melts the electrode and keeps the weld pool fluid. It comes largely from what is stored in the electrical inductance during the interval of short circuiting. The dissipation of this energy is accomplished in an early stage by a transient arc voltage, caused by the rapid breaking of the circuit of the inductive power supply. The arc produced creates a depression in the weld pool.

As the energy from the inductor is discharged to the arc, three things occur: The voltage and current decay; the forces on the weld pool decrease; and the melting electrode advances toward the work. Arc length therefore decreases. Finally, the electrode and the pool again come in contact, the liquid drop is transferred to the pool, and the cycle repeats.

The period of each cycle is uniform, and under the most desirable conditions will repeat between 100 and 200 times per second. Cycle performance is determined by the inductance of the circuit and the voltage setting of the power supply. If the inductance is too low, excessive spatter is generated and cold laps are formed at the edges of the weld. On the other hand, if the inductance is too high, large drops will form at the electrode tip. This allows the arc to fluctuate and again, spatter losses are increased.

Other factors enter into the determination of the cycle—the electrode wire diameter, the electrode extension (distance between the gun and the arc), and the rate at which the electrode is fed into the arc. Correlation of all these elements regulates weld quality. With correct correlations metal transfer is close to 95 per cent.

The process is most practical at current levels below 200 amperes. These currents are compatible with wires preferably less than 0.045 inch in diameter. With fine wire and reduced energy input the size of the weld pool remains small and is easily managed, making all-position welding practical.

Less skill is necessary if the distance from the gun tip to the weld is kept below 1/2 inch. Short extension results in higher frequency and less spatter loss, but even more important, with a short extension, a wide range of electrode feed speed is possible without adjusting the power supply and the arc is easier to manage.

MATERIALS

The properties and new applications of materials used in the mechanical industries

Deep-Drawn Aluminum Machining Stock Available in Larger Sizes

The production of deep-drawn aluminum machining bar stock in sizes from 2 1/2 to 4 inches in diameter has been announced by Harvey Aluminum, 19200 S. Western Ave., Torrance, Calif. The new sizes are made in 1/8-inch increments between 2 5/8 and 3 1/2 inches. In addition, 3 3/4- and 4-inch-diameter bars are available. Diametral tolerances are plus or minus 0.004 inch for sizes from above 2 1/2 to 3 inches and plus or minus 0.006 inch for sizes from above 3 inches to 4 inches. In addition, the material has a surface that for ordinary applications requires no supplementary finishing. The new sizes are being made in all popular aluminum machining alloys and tempers, including 2011, 2014, 2017, 2024, 6061, and 6066.

Cold-Working Qualities Feature of Nickel-Silver Alloy Wires

Two nickel-silver alloys have been made available in wire form by the Bridgeport Brass Co., 30 Grand St., Bridgeport 2, Conn. Containing 18 and 12 per cent nickel silver, these alloys have excellent cold-working properties and are readily formed, bent, or cold-headed. Each of the materials can be suitably joined by soft soldering, silver-alloy brazing, and resistance or oxy-acetylene welding. Screws and rivets, slide fasteners, and optical parts are typical applications.

Silicone Grease Has Application Over a Wide Temperature Range

A silicone grease for use as a rust inhibitor and lubricant on ferrous or rubber parts has been made available by the Silicone Products Department of the General Electric Co., Waterford, N. Y. Designated "SS-4007," this compound maintains its consistency from −75 to 300 degrees F. Applications of the product include its use as a high- and low-temperature thread lubricant, corrosion-preventive compound, and as a lubricant for low and medium swelling rubber components. It is chemically inert, and protects metals against air oxidation. After seventy hours at 212 degrees F. in air, no pitting or corrosion occurred on brass, cadmium-plated steel, zinc, magnesium, aluminum, and steel coated with the product. Salt water will not corrode steel protected by a coating of this grease. The compound also has good storage stability, and is easy to apply.

Stainless Alloys that Have High Strength and Resist Pitting

A group of three stainless alloys of the 18-8 type containing molybdenum has been developed by Cooper Alloy Corporation, Hillside, N. J. Designated the "PH55" series, all have high strength and resistance to pitting.

The first of the series, "PH55A," has high strength, high hardness, and is especially resistant to pitting. High strength, greater ductility, and lower hardness make "PH55B" suitable for parts subject to stress and shock. The third alloy, "PH55C," has greater corrosion resistance, hardness, and strength than "PH55A" but is less ductile and shock resistant.

Stop-Off Material for Brazing Features Ease of Removal

An easy-to-remove material for controlling the flow of brazing alloys during furnace processing has been made available by the Stainless Processing Division, Wall Colmonoy Corporation, 19345 John R St., Detroit 3, Mich. Called "Nicrobraz Red Stop-Off," the product is a liquid which acts as a barrier to these molten alloys by preventing the capillary action needed for their proper flow. It restricts the flow of brazing alloys on any metal surface to which it is applied.

The product is suited for use on parts having small internal holes, fine threads, and similar delicate details from which it must be removed after brazing. Chemically inert at elevated temperatures, it will not contaminate furnace atmospheres. Lacquer thinners or butyl acetate can be used to reduce the product as desired. It can be applied by brushing, dipping, or spraying. Re-

moval is accomplished with either boiling water and brushing (where joint design permits), or with nitric acid, or hydrochloric acid.

Color-Coding Steel with Ink in Spray Can

Reynolds Ink, Inc., 4500 Euclid Ave., Cleveland 3, Ohio, has made ink available in spray cans. Useful for the color-coding of tool steels, the ink dries almost instantly and will not rub off. It may be easily removed with toluol, benzol, alcohol, or lacquer thinner. This product is made in nine colors.

Wax Lubricant for Deep Drawing Operations

A drawing compound, called "700 Wax-Draw," has been announced by S. C. Johnson & Son, Inc., Racine, Wis. The product lubricates to temperatures of 450 degrees F. and at pressures up to 200,000 psi. After drawing, it can be removed with hot water alone. A solvent bath, vapor degreaser or alkaline washer will also remove the residue. Parts are clean and ready for further operations immediately.

The compound will continue to adhere to metal through multiple draws and may be diluted with water to any desired film thickness. Application can be by roller, spraying, dipping, sponge, or other similar device.

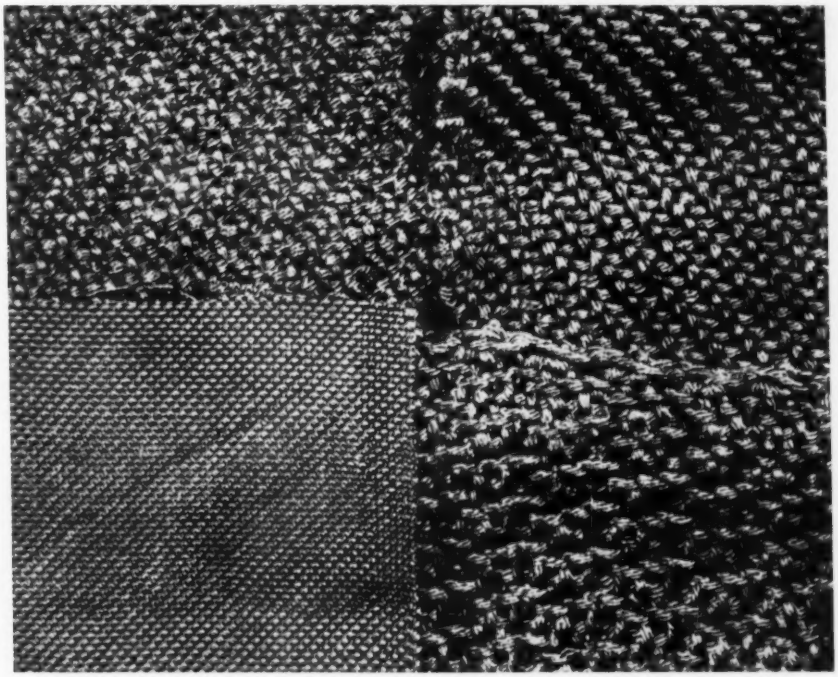
Since coated blanks may be drawn either wet or dry, the wax coating process can be easily adapted to continuous press operations. One gallon of the product, undiluted, will cover up to 2000 square feet of metal. It will cover proportionately more when diluted, and dilutions of 4 to 1 are said to produce good results.

Graphite Produced in Flexible Textile Form

Graphite manufactured in flexible fiber and fabric form has been made available in experimental quantities by the National Carbon Co., Division of Union Carbide Corporation, 30 E. 42nd St., New York 17, N. Y. In a newly developed process, organic textiles are converted directly to graphite with a purity in excess of 99.9 per cent. Any textile form can be produced. Four weaves of graphite fabric are shown in the accompanying illustration.

At ordinary pressures, graphite has no melting point, but it sublimes at approximately 6600 degrees F. It also has the unusual property of becoming stronger at higher temperatures, the tensile strength of graphite at 4500 degrees F. being about twice that at room temperature. Graphite oxidizes in air at temperatures in excess of 750 degrees F. In addition, the known properties of graphite fabrics are unaffected by liquid nitrogen at a temperature of −320 degrees F.

Graphite textiles are resistant to attack by acids, alkalies, and organic compounds, except for those of a highly oxidizing nature, and are unreactive with many molten metals. They have excellent electrical and thermal conductivity, and



Graphite fibers and fabrics can be produced in the same range of textures as are available in conventional textiles. Here are four of the various weaves of graphite cloth being experimentally produced.

since they are in flexible form, are immune to thermal shock. Graphite also has good lubricating properties.

Specific data on a typical form of graphite fabric, square weave, 28 by 28 construction, are as follows: weight per square foot—0.04 pounds; tensile strength, room temperature—10 to 15 pounds per inch width; electrical resistance, room temperature—1/2 ohm per inch width per inch length.

Flexible Vinyl Magnet Material

The development and production of a flexible magnet material having magnetic permanence has been announced by B. F. Goodrich Industrial Products Co., Marietta, Ohio, a division of the B. F. Goodrich Co. The new product is "Koroseal" vinyl plastic, specially compounded and processed to react exactly like metal or ceramic magnets. It can be extruded in an unlimited number of shapes and can be cut without impairing its magnetic qualities. In addition, it can be magnetized in any direction.

The product has good magnetic properties, good aging and chemical resistance, and is an electrical insulator. It is adaptable for best pole location, capable of being magnetized with multiple poles, and can be spot-magnetized. The compounds of which it is made can be varied to give the desired amount of flexibility, softness, and magnetic strength.

Aluminum Alloy for Bright Anodized Finishes

A bright aluminum alloy has been developed for decorative uses by the Aluminum Company of America, 763 Alcoa Building, Pittsburgh 19, Pa. Known as alloy "X5557," this material can be given lustrous anodized finishes and has good workability. The bright, chromium-like finish of the alloy obtained after polishing, brightening, and anodizing has good resistance to corrosion.

The product is available in coiled or flat sheet and plate, as well as circles and blanks. It can be supplied in mill finish, and one-side, bright mill finish. Applications are largely in the automotive, appliance, and architectural fields.

Easy-to-Cast Transparent Epoxy

A transparent plastic called "Maraglas" resin No. 655 has been announced by the Marblette Corporation, 37-31 Thirtieth St., Long Island City 1, N. Y. The product is an easily cast thermosetting material which provides 90 per cent light transmission, does not discolor, and has low shrinkage (0.0025 inch per inch). Bubble-free castings of the material having hard, weather-resistant surfaces that are free of tackiness and do not craze or crack are readily produced.

Supplied as a low-viscosity liquid, the resin does not need melting before blending with a liquid hardener. The resin-hardener blend has a pot life of ten hours. The mixture is cast in molds treated with a release agent. Castings become permanently solidified following a brief heat cure. The product forms a bond with many other materials, and can be employed as a laminating resin or adhesive.

Its uses include the making of models, prototypes, machine housings, lighting fixtures, panels and structural parts, tubes, and piping.

Bath for Increasing Surface Hardness of High-Speed Steels

A surface-hardening bath for high-speed cutting tools has been made available by the A. F. Holden Co., Detroit, Mich. Referred to as the "Hy-Speed Case" process, it is claimed to give greater wear resistance and increased surface hardness to high-speed steels and high-carbon, high-chrome alloys after they have been hardened, tempered, and ground.

For maximum results, the bath is aged overnight for twelve to fourteen hours before being put in operation and the tools are thoroughly cleaned to remove oil, dirt, or other contaminating substances. Operating range of the process is from 950 to 1150 degrees F. but the temperature should not exceed that of the original tempering. The time required is determined by the size, shape, and application of the tool and can vary from five to ninety minutes. After treatment, the tools are allowed to cool in air, and are then washed and dipped in oil to prevent rust and corrosion. The bath compound is completely soluble and washes away readily in clean, hot water. To maintain an efficient operating level it is necessary to replace only 5 per cent of the bath for every forty-hour period of use.

High Impact Strength Is Feature of Die-Metal Alloy

A high-strength, zinc-base die-metal alloy has been developed by the American Smelting & Refining Co., 120 Broadway, New York 5, N. Y. Called "Formaloy," the material has high impact strength as its most significant feature. It also has high tensile strength, and a uniformly fine, dense grain structure. The die metal is readily workable and no special techniques are required for casting or machining. Applications include drop-hammer punches and dies, draw-press dies, stretch-press dies, blanking dies, hydro-press form-blocks, and punch-press fixtures.

TOOL ENGINEERING *Ideas*

Tools and fixtures of unusual design and time- and labor-saving methods that have been found useful by men engaged in tool design and shop work

Tube-Slitting Punches Work Out-of-Phase

CLINT MCLAUGHLIN, Rockaway Beach, N. Y.

A press operation involving two punches that function out-of-phase produces a long slit required in the wall of tubing. The work is shown in View X of the accompanying illustration. Tubing diameter is 3/4 inch, with a wall thickness of 0.050 inch. The dimensions of the slit are 3/32 by 2 inches.

View Y shows the press setup. Tubing *A* rests on support *B*, the top of which is concave to conform to the diameter of the tubing. Since the piercing pressure is applied at an angle, it is necessary to restrain the tubing from moving axially. This is done by two toe dogs *C*.

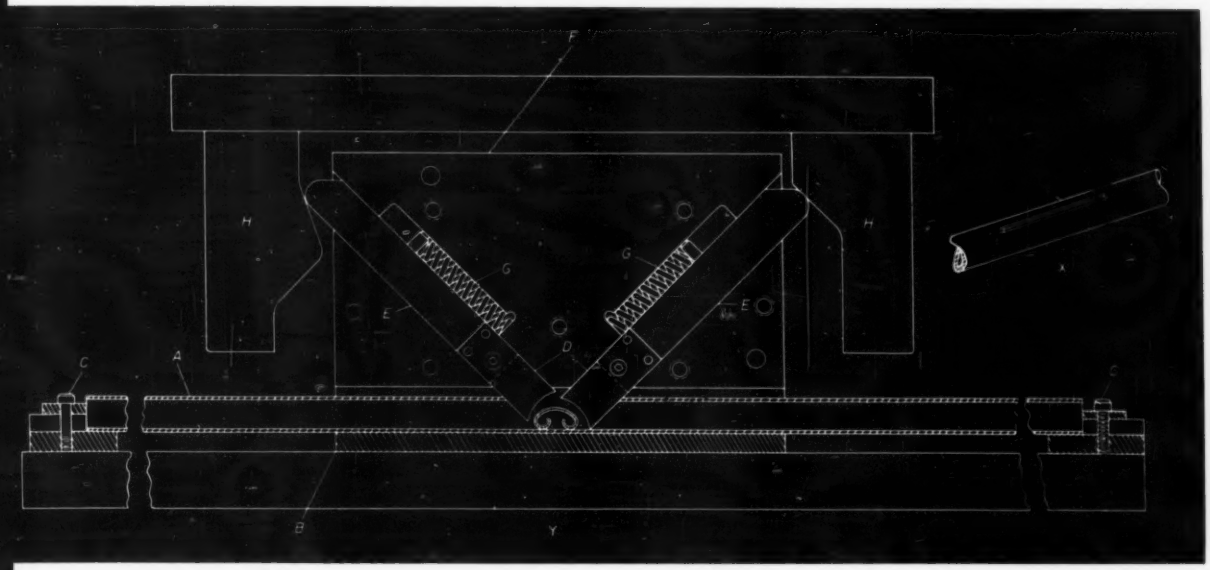
The punches *D* are replaceable blades, doweled and screwed to blocks *E*. These blocks slide in channels toed in at an angle of 45 degrees in tool body *F*. Compression springs *G* keep the blocks normally raised.

Bearing against the end of each block and mounted on the bottom of the die shoe is a cam *H*. As can be seen from their differing profiles, the two cams prevent the punches from interfering with each other.

When the press ram descends, the left-hand punch advances first, piercing the tubing, then retracts slightly. Further descent of the ram advances the right-hand punch, and the slit is completed. As the ram moves up, the right-hand punch retracts first. The left-hand punch next re-enters the slit, and then it, too, retracts. When the tubing is removed from the press, the slug drops out of one end of the work.

A satisfactory slit is produced, but because there is no supporting die within the tubing, some distortion is inevitable. To eliminate this, a proposed alternate design has the punches toed-in in a horizontal plane, with a spring-loaded semicircular pad lowered over the top of the tubing.

To prevent the punches (D) from interfering with each other, the profiles of the cams (H) cause the punches to advance and retract independently.

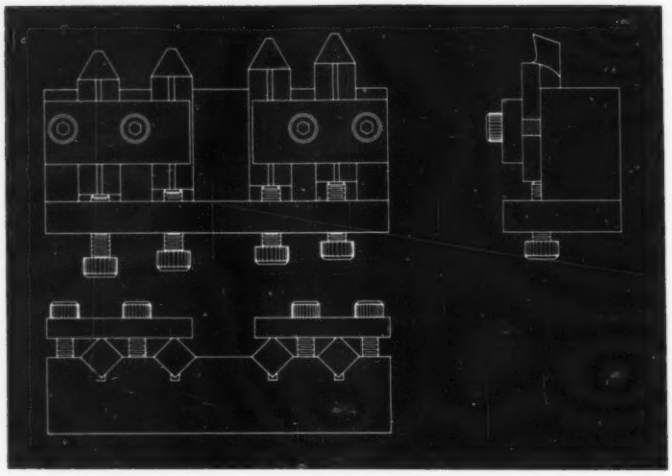


Grooving Tools Held in Special V-Block

H. J. GERBER, Stillwater, Okla.

A multiple tool-block having V-shaped seating surfaces assured the accuracy of a grooving job on a heavy-duty engine lathe. Four grooves, a precise distance apart, had to be formed simultaneously.

In order to prevent their accidental displacement, the standard, square tool blanks used were seated in milled 90-degree vees, as shown in the illustration. Diametral adjustment of the tools was provided by a backup screw at the rear of each tool. The working ends of the tools were ground (and later reground) without removing them from the block. This was done by setting up the block on a tool and cutter grinder. Each tool was ground to fit a master template which corresponded to the required spacing. A duplicate tool-block was put in service whenever regrinding was necessary, thus providing uninterrupted production.



The V-shaped surfaces of the block maintain accurate distances between the tools.

Resistance Welder Automated for Multiple Operations

BUCKLEY SULLIVAN, Shaker Heights, Ohio

An arrangement for the automatic positioning, cutting, forming, and welding of the parts of a simple assembly is here illustrated. The workpiece, Fig. 1, is a 6-inch length of 3/4-inch steel tubing *A*, Fig. 2, having five pieces of 3/16-inch diameter wire *B* formed and welded to the periphery. The device is used in combination with a standard 100-kva resistance welder.

Tooling consists of three basic sections: a stock feed mechanism for the five wires, with cutoff blades and a roller to hold the wires in position after the cutoff operation; a hopper feed for the lengths of tubing; and the welding station. The wire feed arrangement is mounted on the welder but is supported independently, as is the hopper feed for the tubing. Five horizontal power-feed reels (not shown) each hold a coil of wire. From these reels, the five wires are led through power straighteners (not shown) and two bushing plates *C*, each having five guide bushings. Between these plates is a pair of rubber-covered feed rolls *D* which are synchronized by a roller chain and sprockets. The rolls are held together under spring pressure and the lower of the two rolls is driven by an air cylinder, through a rack and pinion and an over-running clutch.

After passing through the guide bushings in the second of the bushing plates, the wires enter a cutoff die *E*. The lower die blade is fixed and the upper blade *F* is operated by a long lever *G* at a mechanical advantage of 5 to 1. One end of this lever is actuated by the pressure cylinder for the upper electrode *H* of the welder. By arranging steps and the shear angle on the cutoff blade, the five 3/16-inch wires are cut off smoothly without a sudden breakthrough to adversely affect the welder.

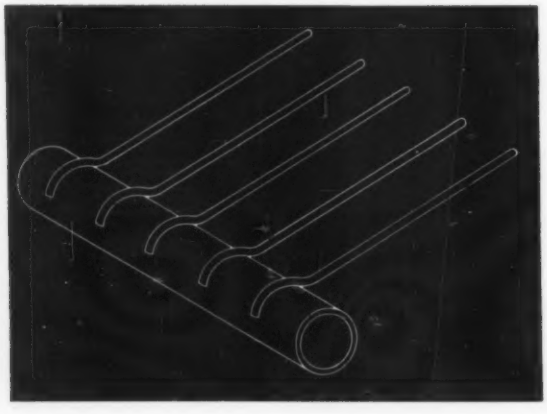


Fig. 1. Welded assembly that is produced automatically on a resistance welder.

From the cutoff blades, the five wires lead through two bronze guides *J* and under a rubber pressure roll *K* positioned between the guides. Both guides are cast with wide openings on the wire-entrance side to automatically align the wire as it feeds in from the cutoff die. The rubber pressure roller holds the wires in the guide slots, during and after the cutoff operation, until the weld is completed, and also prevents the wires from shifting lengthwise. This roller is covered with soft rubber and is mounted on the frame of the cutoff die. The two forward guides *J* are secured to a hinged plate that swings down to allow ejection of the finished part.

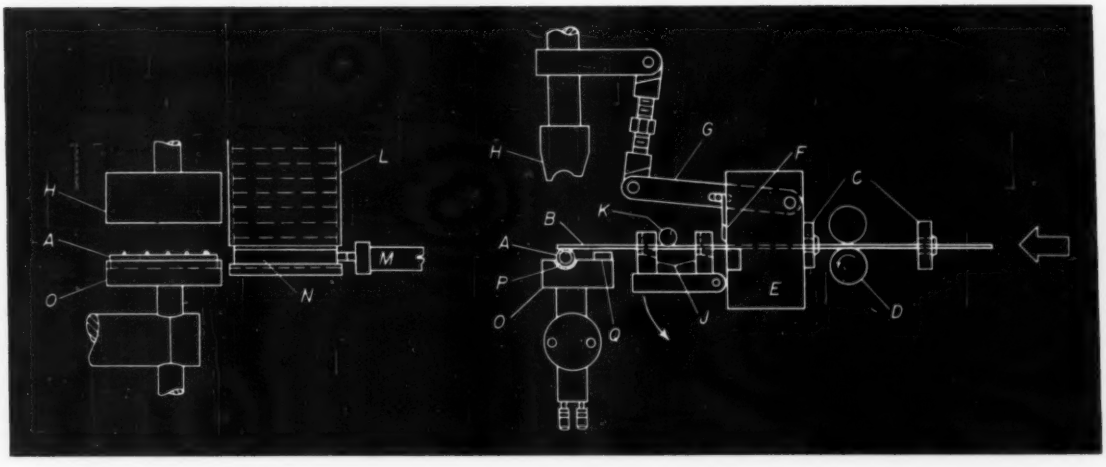
The hopper feed device *L* for the lengths of tubing is mounted on the front of the machine, and an air cylinder *M* is secured to one end of the hopper. When the air cylinder is triggered, a cross-bar on the end of the piston-rod pushes the bottom tube *N* in the hopper forward into the lower work-holding electrode *O*. This automatically forces the previously completed part out of the machine. When the piston of the hopper cylinder retracts, another tube drops into position, ready for the next feed stroke.

The welding station consists of a simple, elongated upper electrode that both forms and welds the wire, and the lower electrode which holds the tube in a semicircular nest formed of flat, braided copper cable *P* brazed to the lower electrode. Under welding pressure, the cable crushes down to form a perfect contact with the tubing. This eliminates both deformation of the tubing and poor welds from improper contact between the tube and the electrode. One side of the lower electrode holds a carbon block *Q* that assists the upper electrode as it forms the wires around the tubing. In addition, the carbon block supports the wires after the front guides have been automatically lowered for ejection of part.

To start operation, the five wire reels are loaded, and the wires are run through the straighteners and the bushings in the first bushing plate, up to the rubber feed rolls. With the welding circuit open, the machine is intermittently operated until the feed rolls have gripped all five wires. They are then threaded through the second bushing plate and the cutoff die. The machine is slowly operated through the rest of the cycle, leaving the ends of the five wires trimmed off and even. Then, after setting the machine at rest, the tube hopper is filled, the welding circuit is energized, and the cooling water is circulated.

When the control is set on automatic and the start button is depressed, the air cylinder on the hopper feed operates, causing a tube to be pushed into the lower electrode. At the same time, the air cylinder drives the wire feed rolls, advancing the wires through the front guides and over the tube. The air cylinder pistons of both the hopper feed and the feed rolls retract, and the welding head starts down, activating the die blade which cuts off the five wires. Held in place by the pressure roll between the guides, the wires are contacted by the upper electrode which forms them around the tube. Then the welding cycle begins. As soon as the part is welded, the front wire guides lower away from the wire and the upper electrode rises. The hopper feed cylinder pushes in a new tube, forcing out the completed assembly as the feed rolls start feeding more wire forward. As soon as the hopper feed piston reaches the end of its outward stroke, an air cylinder pops the front wire guides back into place and the cycle repeats.

Fig. 2. Setup of special tooling for automation of a resistance welder to produce the assembly seen in Fig. 1. In addition to the welding operation, the wires are cut to length and formed to fit the tubing.



INGENIOUS MECHANISMS

Mechanisms selected by experienced machine designers as typical examples applicable in the construction of automatic machines and other devices

Shaft-Mounted Speed Reducer

CLINT MCLAUGHLIN, Rockaway, N. Y.

Shown in the accompanying illustrations is a geared speed reducer of unusually compact design. The small cylindrical unit mounts directly on the drive-shaft and transmits its torque to the driven member (not shown) by means of a V-belt. Assembled appearance and construction details can be visualized from the partial section in Fig. 1 and the exploded view in Fig. 2.

The center section of the speed reducer consists of a steel sleeve *A*, internal gear *B*, and pinion *C*. Internal gear *B* is pressed into the steel sleeve, thus permitting them to turn as one. (If these units were produced in quantity, the internal teeth could be cut directly in the sleeve.) Pinion *C*, which is keyed to drive-shaft *D*, meshes with this gear.

Two bronze end plates *E* have shoulders that are turned to a running fit with steel sleeve *A*. The bearing holes through which the drive-shaft passes are located off center by the distance

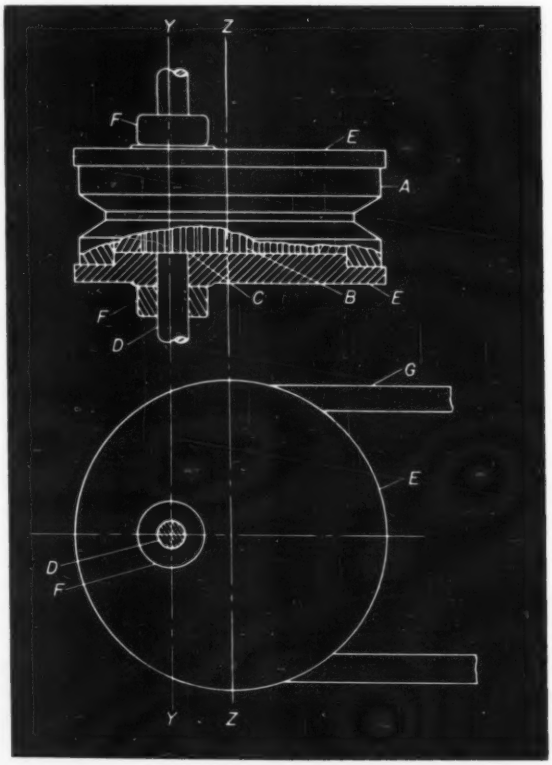
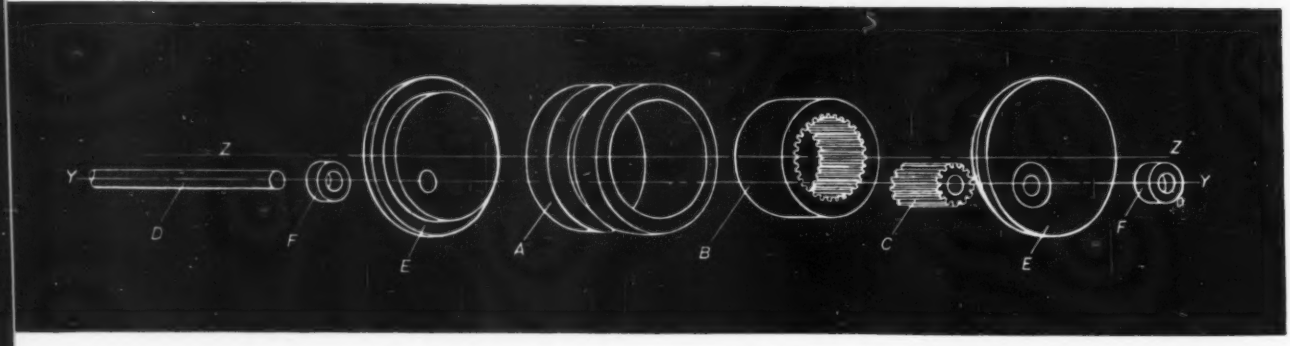


Fig. 1. (Right) Compact speed reducer mounts directly on drive-shaft (D). Driven sleeve (A) is coupled to moving machine member by V-belt (G).

Fig. 2. (Below) Exploded view of shaft-mounted speed reducer. For quantity production, internal gear (B) can be eliminated and the teeth cut directly in sleeve (A).



necessary to provide proper engagement between the internal gear and the pinion. Collars *F* are locked to the shaft adjacent to the end plates and serve to retain the assembly intact. The unit can be packed with grease before assembly and, if desired, a grease fitting can be added for relubrication.

When the speed reducer is in operation there is a tendency for it to rotate with drive-shaft *D* about axis Y-Y. This proneness toward eccentric rotation is counteracted by the pull of V-belt *G* which restricts rotation to steel sleeve *A* about axis Z-Z. A secondary effect of the tendency to rotate about axis Y-Y is that adequate tension is maintained on the V-belt. If it is desired to hold the unit rigid, a support arm can be provided from a point on the machine frame to one of the end plates.

Mechanism Compensates for Lead-Screw Pitch Errors

Pitch errors in the lead-screws of a thread-cutting or a thread-grinding machine can be compensated for by the mechanism shown in the accompanying illustration. The drawing shows, in View X, a sectional view of the lead-screw drive in which motion is transmitted through gearing and a differential unit. If the outer casing of the differential is held stationary, the differential acts as a coupling, and drive from the spur gear *A* is transmitted to the lead-screw in a ratio of 1 to 1, but in the opposite direction of rotation.

A non-self-locking worm *B* meshes with teeth cut on the periphery of the differential casing. On the outer end of this worm is keyed a plain spur gear *C*, as can be seen in View Y. Meshing with gear *C* are two rack-toothed plungers, each of which has a roller at the lower end making contact with one of a pair of templates *D* and *E*.

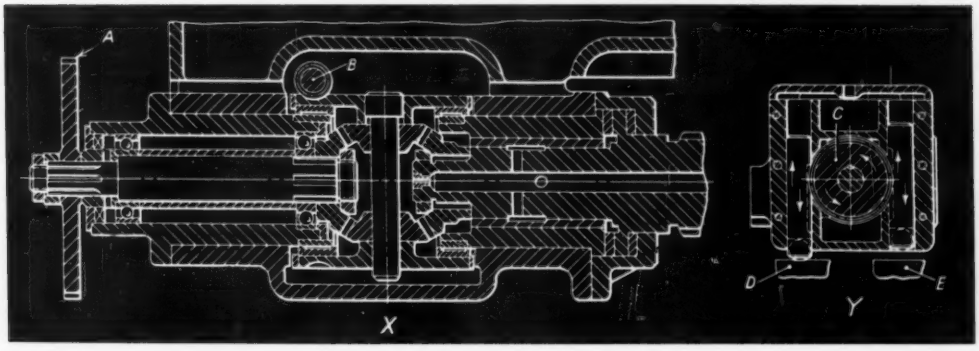
As gear *A* starts to rotate, the outer casing of the differential will turn in the same direction, rotating worm *B* and spur gear *C* until one of the plungers makes contact with a template. When this occurs, worm *B* can no longer rotate, and the outer casing of the differential is held stationary. Drive to the lead-screw is now transmitted in the manner previously described.

As the lead-screw moves axially, the plunger travels along the upper edge of the template, and as long as the template is flat and parallel with the machine guide ways, the differential casing will be held stationary. However, the edge of the template is arranged with concave or convex curves, which correspond to the known pitch errors in the lead-screw, and when the plunger encounters one of these curves it is raised or lowered accordingly. These movements rotate gear *C*, which, in turn, rotates worm *B*, and thus the outer casing of the differential is also caused to rotate.

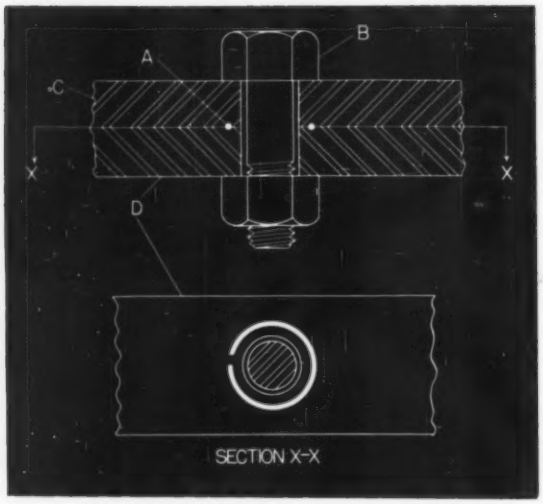
This rotation has the effect of adding to, or subtracting from, the rotary movement of the lead-screw, and correspondingly reducing or increasing the axial traverse of the carriage, thus compensating for pitch errors. In View Y, one of the plungers has contacted a concave area on template *D*, which has resulted in a counter-clockwise rotation of gear *C*.

Because of the backlash between the lead-screw and its nut, only one flank of the thread is critical for each direction of carriage traverse. Two templates are necessary, therefore, to compensate for the pitch errors present on each flank of the lead-screw.

The surfaces of templates (D) and (E) are convex or concave at different points to correspond to pitch errors in the lead-screw.



SHOP KINKS



Slippage between bolted parts can be prevented by a ring of steel spring wire.

Wire Rings Prevent Slippage of Bolted Parts

JOSE C. SOBKOWIAK, Jackson, Mich.

It is sometimes necessary to make certain that there will be no slippage between bolted parts. Single turns of steel spring wire, cut from a reasonably close-wound coil spring and placed between the parts at each bolt, can help to prevent any movement of the pieces relative to each other.

As shown in the accompanying illustration, the coil of spring wire *A* must be a little larger in diameter than the bolt *B*. When the bolt is tightened, the spring wire becomes completely embedded in the two parts *C* and *D*. The wire diameter should be large enough to prevent the slippage, but small enough to allow the bolt to close the gap between the parts.

Roll Measurement of Arcs

F. MURRAY, Chicago, Ill.

The radius of an arc can be conveniently measured with a depth micrometer and three equal-diameter rolls arranged as shown at the left in the illustration. A single micrometer measurement *H* and the roll diameter *D* are substituted in the equation

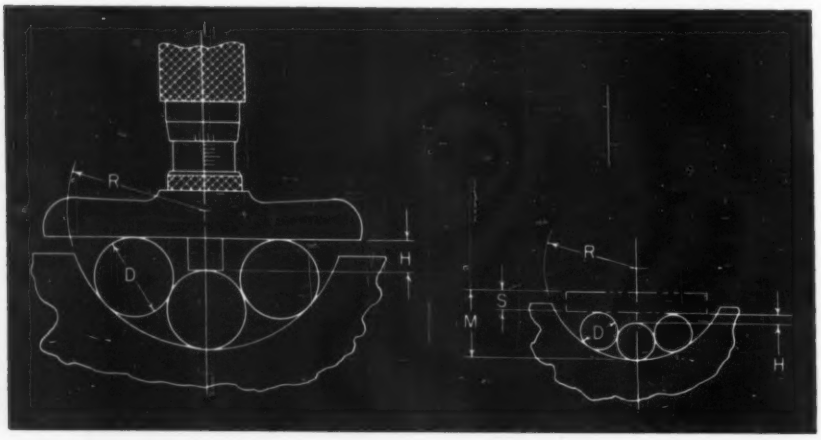
$$R = \frac{D^2}{2H} + \frac{D}{2}$$

which is then solved for the radius of the surface being checked.

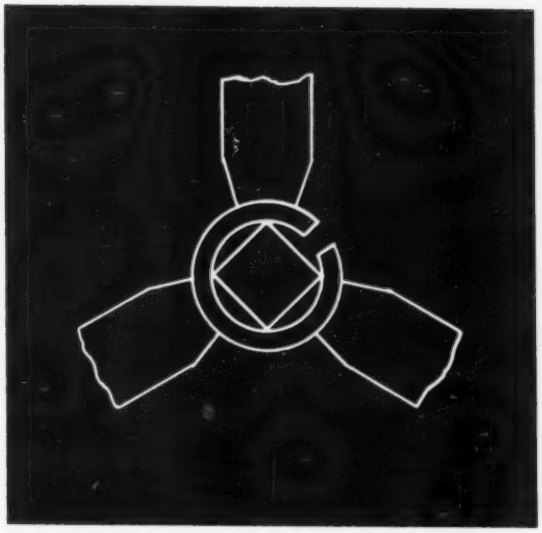
In cases where the edges of the surface prevent the micrometer from contacting the two outside rolls, a spacer, shown in phantom at the right in the illustration, is placed across the top of the rolls. An outside micrometer is used to measure the distance *M* from the top of the spacer to the bottom of the middle roll. The value for *H* can then be obtained from the equation

$$H = M - (S + D)$$

where S is the thickness of the spacer.



A convenient yet accurate method for measuring the radius of an arc.



A split pipe nipple in this instance permits square stock to be held in a three-jaw chuck.

Chuck Jaws Bushed with Pipe Nipples for Non-Round Work

BUCKLEY SULLIVAN, Shaker Heights, Ohio

An odd piece of square, octagonal, or other non-round stock can be held in a three-jaw chuck bushed with a split pipe nipple, as in the illustration. Like regular pipe, nipples are made "standard-weight," "extra-strong," and "double-extra-strong"—the difference being in the wall thickness and the inside diameter.

By keeping an assortment of 3-inch nipples in the shop, it is possible to bush the jaws for practically any size of work, because of the opening flexure provided by the split. In the accompanying table are the inside diameters of standard-weight, extra-strong, and double-extra-strong nipples of 1/8- to 2-inch nominal size.

Inside Diameter (in Inches) of Standard-Weight (S), Extra-Strong (ES), and Double-Extra-Strong (DES) Pipe Nipples

Inside Diameter	Nipple Size	Inside Diameter	Nipple Size
0.215	1/8 ES	0.824	3/4 S
0.252	1/2 DES	0.896	1 1/4 DES
0.269	1/8 S	0.957	1 ES
0.302	1/4 ES	1.049	1 S
0.364	1/4 S	1.100	1 1/2 DES
0.423	3/8 ES	1.278	1 1/4 ES
0.434	3/4 DES	1.380	1 1/4 S
0.493	3/8 S	1.500	1 1/2 ES
0.546	1/2 ES	1.503	2 DES
0.599	1 DES	1.610	1 1/2 S
0.622	1/2 S	1.939	2 ES
0.742	3/4 ES	2.067	2 S

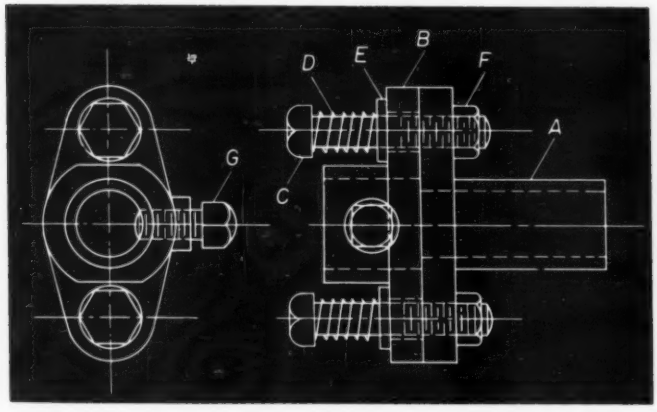
Dual-Purpose Holder

CARL BEDDIG, Oakland, Calif.

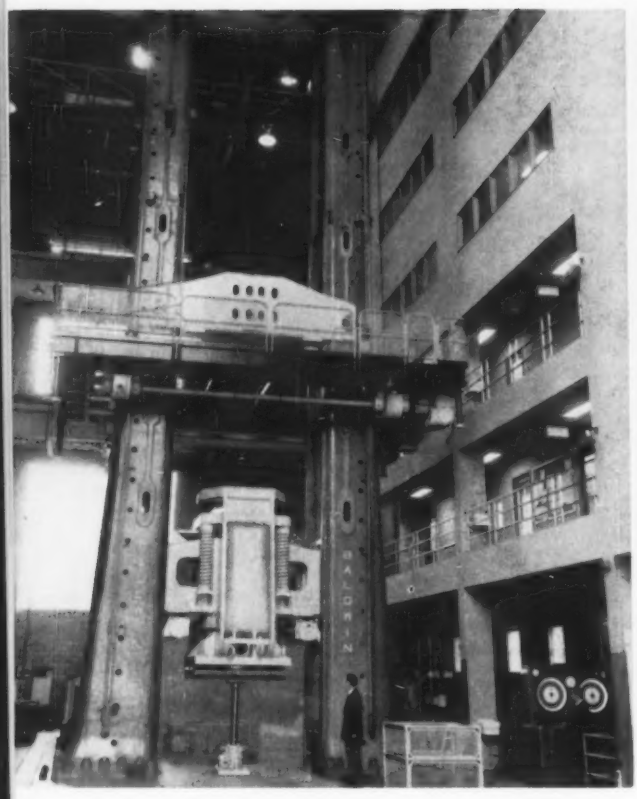
A combination tap- and reamer-holder for use on turret lathes and automatic screw machines is here illustrated. The device has a pull-out action which permits the tap, when cutting, to move forward at a rate equivalent to its lead and, on its release from the threads, to withdraw from the work-piece under spring pressure. In addition, the holder may be used for reamers since the cutting tool is allowed a floating motion for self-centering in the prepared hole.

The device consists primarily of two parts, a shank *A* and a tool-holder *B*. To reduce sliding friction between these members to a minimum, their contacting faces are ground and polished. Shank *A* is threaded to receive bolts *C* which pass with 1/32-inch clearance through holes in part *B*. Springs *D*, washers *E*, and lock-nuts *F* permit the necessary pull-out action of holder *B*. During tapping, this member can slide forward on the bolts by compressing the springs.

In use, a tap or reamer, equipped with a bushing of the proper size, is inserted into the holder and secured in place by set-screw *G*. When tapping, the spring pressure should be adjusted by lock-nuts *F* according to the weight of the tap being used. The spring should keep parts *A* and *B* in contact when the tap is released from the thread. Only the floating action due to the clearance provided in the holes for the bolts in tool-holder *B* is utilized when reaming.



Holding device for taps or reamers used on turret lathes or automatic screw machines.



TORTURE TEST— Lehigh University's Fritz Engineering Laboratory, Bethlehem, Pa., uses this Baldwin universal testing machine to apply a static load to a special Duff-Norton worm-gear jack. The machine is claimed to be the largest of its type in existence, being capable of applying a 5,000,000-pound load. Here, the jack, rated at 200 tons, sustained a 1200-ton load before failing.

AUTOMATIC SCREWDRIVER— A Setomatic machine at SKF Industries' Philadelphia plant puts setscrews in lock collars for pillow blocks. Operator is shown loading vibrating hopper with the setscrews. The machine, made by the Standard Pressed Steel Co., Jenkintown, Pa., is handling 90 per cent of the bearing assembly work load. An insertion rate up to 2500 screws per hour is possible.

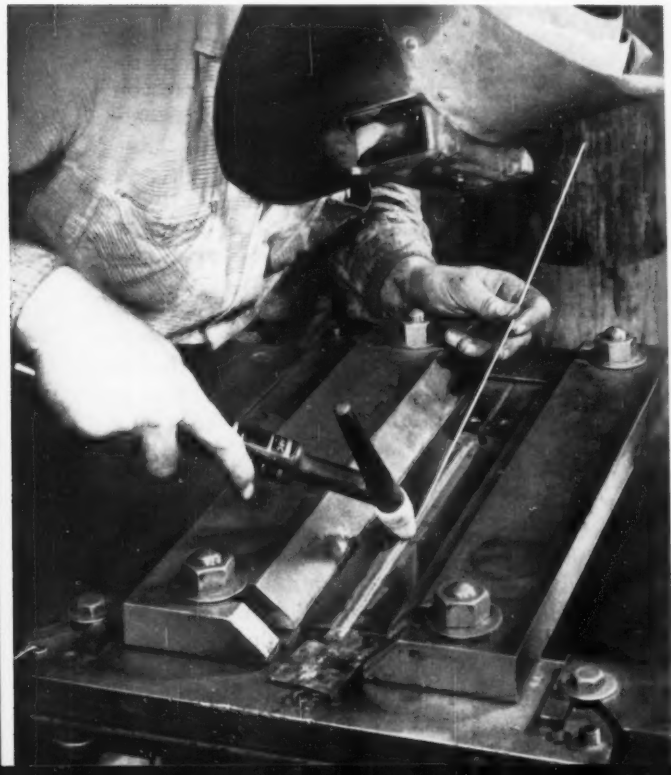
In Shops Around the Country

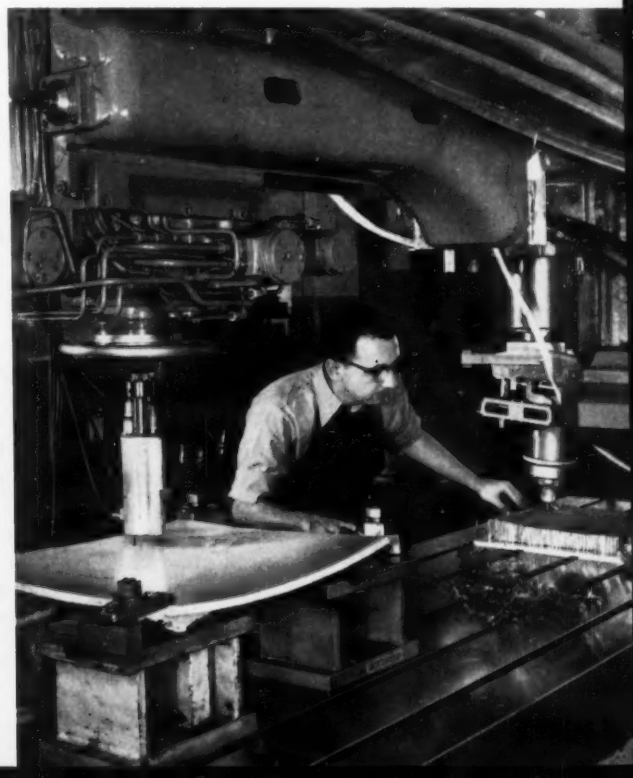
Camera highlights of some interesting operations performed in various metalworking plants throughout the nation by unique applications of machines and tools

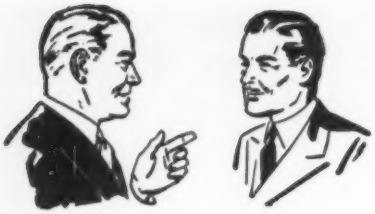
BUSY BEE— The Solar Aircraft Co., San Diego, has developed this machine to convert spools of metal ribbon to honeycomb material for the cores of aircraft and missile structural panels. Rollers press the metal into corrugated strips, then adjacent strips are pressed together to form square or wave cells. Finally, welding heads move up and down the strips, performing resistance welds where the convolutions make contact.

SAW MAKER— A wide band saw used in the lumber industry is welded by Heliarc at the Disston Division of the H. K. Porter Co., Inc., Philadelphia. The process involves an argon-gas atmosphere, to prevent oxidation, with an intense electric arc between a tungsten electrode and the band. A clean, dense weld with a uniform bead is obtained, requiring little finishing, and one which is as strong as the parent metal.

HULA HEAD— A cutter-head developed by the Martin Co., Baltimore, simulates the hip movement of a Hawaiian dance to machine compound-contour structural shapes from honeycomb-core material. Its controlling stylus has five pick-up points, permitting a standard three-axis machine to handle five-axis operations. The stylus rides the surface of the model, transmitting rise, fall, and tilt motions to the cutter-head.







Talking With Sales Managers

BERNARD LESTER
Management Consulting Engineer

The Ash Heap of Abandoned Projects

"RIGHT NOW, during a rally in business, our most profitable sales source is in the ash heap of projects which were abandoned sometime in the past. Years ago we often missed out, after business started to revive, by not following up jobs previously worked on and which were then presumed to be dying or already dead." This statement, contained in a letter from an equipment sales manager, has considerable significance at this time.

One of the greatest lessons to learn in marketing is the overwhelming importance of the timing of the sales effort. The buyer's "No" of yesterday may be the "Yes" of today.

Although expenditures for new plant equipment this year will probably not reach those of 1957, they will doubtlessly exceed last year's by a good margin. A backlog of need for durable goods has been growing. During the remainder of this year it is likely that many projects cast aside or pronounced dead will come to life.

Recently we came across the following interesting case. A sprawling corporation bought an existing plant and made plans to renovate and re-equip it. Bids were received for various machines. Then top management decided to abandon the project and offer the plant for sale. Six months later the plant was bought by another company which decided to use it in much the same way as did the first company.

A sales engineer for a machinery builder had prepared a sizable layout for equipment when renovation was planned by the first company. From neglect, as time went on, he failed to keep in touch with that firm once the project was abandoned. Even though he was called in before the purchase of the equipment by the second company, he had sacrificed his original strong position and eventually lost the order.

It is easy for us to form the practice of pigeonholing or tagging orders and projects. We are inclined to attach one single cause to one single effect. We speak of orders won, lost, or abandoned, when this should not be so.

We label orders lost because of high price, long delivery, or unsuitable equipment, while actually the reasons for the loss may be different and more complex. Besides, cannot unfavorable price or delivery differentials often be overcome by sales skill? Cannot equipment pronounced unsuitable sometimes be made suitable by clever adaptation?

This handy method of order-labeling may be very costly, particularly when it comes to classifying machinery inquiries that do not materialize. Delayed, postponed, abandoned, or dead—these should be only relative terms to sales people, since they change like the weather.

A manufacturer recently traced the history of over fifty negotiated orders for engineering-plant equipment. He found that fifteen of the projects had at one time or another been abandoned or pronounced dead. Had he and his sales engineers not been disciplined in following up such projects, several of them would have gone to competitors when they were finally revived.

These suggestions may be timely and fitting:

See that all inactive negotiations are promptly reviewed to verify their condition. Make sure you actively establish continued interest in the customer and express your anxiety to serve him.

Stress changing conditions of delivery and completion. With accelerated business activity, so many purchasers want quick action, but don't get it. Warn the hesitant prospect of expanding delivery schedules as business activity rises.

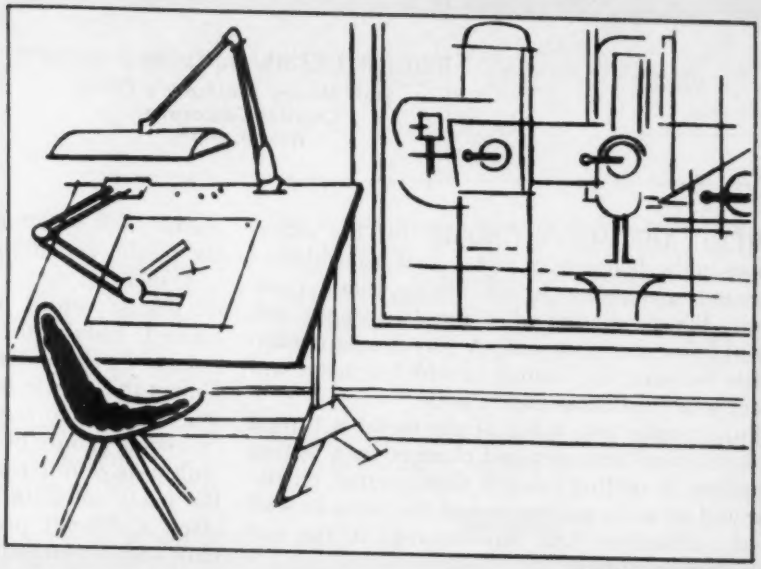
Adopt a plan so that every dormant negotiation will be checked frequently. When a project is presumed to be dead, check to see whether it may not come to life elsewhere.

Train salesmen in the necessity of pursuing every project until it is lost to you, or gone forever. Young salesmen—those who have not yet been knocked over by the loss of a "once dead" project—especially need this training.

It is understandable for a salesman to get wrapped up in a new project and neglect an old one which looks as though it might never close. In our business, don't "let sleeping dogs lie."

MACHINERY'S

Reference Section



WHAT THE DESIGNER SHOULD KNOW ABOUT PRODUCTION

PART 9—STAMPINGS

June 1959

What the designer should know about production — Part 9

STAMPINGS

THEODORE KOERNER, Jr., Technical Specialist
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Detroit, Mich.

THERE ARE MANY CAUSES for the differences in the behavior of metals that occur during forming or drawing. In considering these operations, the mechanics of a tensile-strength test should first be reviewed. A direct relationship exists between the manner in which a metal will react in a tensile test and in a die.

In a tensile test, a bar of the metal is turned to a standard diameter and clamped in a testing machine. A pulling force is then exerted on the bar and an accurate measure of the force as well as the elongation that has occurred in the test piece are recorded.

As the force is gradually increased, the bar elongates. At first, only a slight increase in length is obtained for a relatively large increase in force. At the elastic limit similar small elongations of the test piece occur with notably less increase in force. This condition will continue until the ultimate strength is reached, at which point the test bar will fail completely by separating. That portion of the stress diagram (Fig. 1) between the elastic limit and the ultimate strength is called the plastic working range of the metal.

A sheet of metal, distorted only slightly, will on release return to its original shape. To be formed, metal must be bent, pushed, or pulled beyond its elastic limit to take a permanent "set." Unless the elastic limit is exceeded, no forming will take place, but if the ultimate strength is exceeded, failure of the metal will result. In the multitude of different die operations for forming the many intricate shapes required today, it is often a difficult problem to exceed the elastic limit without exceeding the ultimate strength and thus rupturing or tearing the metal.

Bending and Flanging

When a loose bend is made, the neutral axis is considered to be located at the center of the stock thickness. The metal between the neutral axis and the outer surface of the bend is in tension and the metal between the neutral axis and

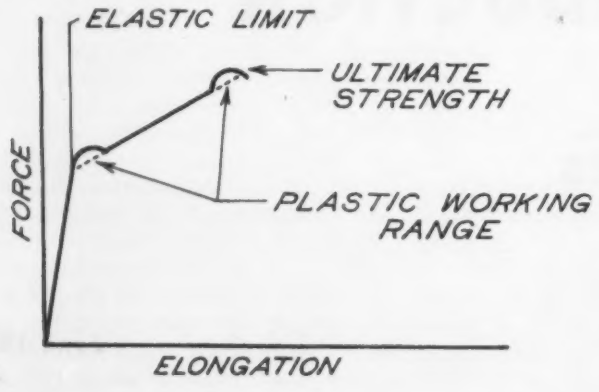


Fig. 1. Stress diagram denoting that portion of the curve falling between the elastic limit and the ultimate strength. The range between these two points is called the plastic working range of the metal.

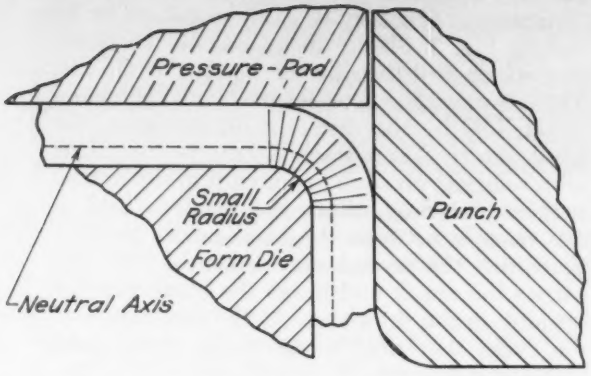


Fig. 2. Neutral axis in a loose bend is considered to be in the center of the metal. By using a pressure-pad and a small radius on the form die this axis can be moved to a distance about one-third of the way from the inner bend surface.

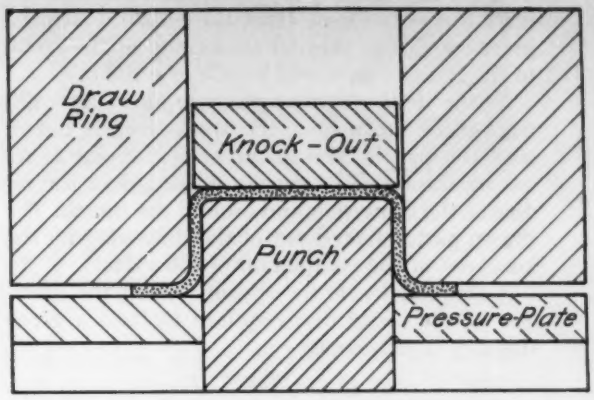


Fig. 3. Here, seen in detail, is die for simple drawing operation in which a cup-shaped part is formed. The draw-ring moves downward, locking the blank between it and the pressure-plate, and drawing the work over a stationary punch.

the inner surface is in compression. In other words, the metal outside of the neutral axis is being stretched while that inside of the axis is being squeezed.

The use of a pressure-pad and a small radius on the form die will relocate the neutral axis to a distance approximately one-third the stock thickness from the inner surface of the bend, as illustrated in Fig. 2. If this method of bending (or flanging) is employed, the position of the neutral axis causes less of the metal in the bend to be in compression and more to be in tension.

Flanging is another forming operation. Basically, there are four types of flanges: straight, stretch, shrink, and reverse-contoured. A straight flange is formed over an edge of a flat piece of metal. Tears or cracks may occur in the outer radius of the bend if heavy-gage metal is formed over a small radius.

In the case of the stretch flange, the forming is done over an edge of an "inside" radius of a piece of metal. An example of this type of flange would be the forming of an edge on a hole in a part. Tears or cracks may occur if a stretch flange is too large or the metal too thin. Conversely, the shrink flange is made by forming over an edge of an "outside" radius. An edge formed on a disc is a shrink flange. Gathering of the metal, or wrinkles," may occur if a shrink flange is too wide or the radius of the bend too small.

A reverse-contoured flange, as the name implies, is formed over an edge of a piece of metal having a contour involving both "inside" and "outside" radii. Failures in this case may be by either tearing or wrinkling.

Drawing

Drawing operations are those which cause metal to flow plastically from one shape to another under, primarily, a pulling or tensile load. Very high compressive stresses result in the area where the shape is being changed.

In Fig. 3, a cup is shown being drawn in a die. The components of this die are the punch, the pressure-plate, the draw-ring, and the knock-out. Essentially the drawing operation is performed as follows: A disc of metal is placed on the pressure-plate which is supported higher than the punch by a spring or pressure from an air cylinder. When the die is closed, the draw-ring contacts the work-piece and forces it against the pressure-plate. As the draw-ring continues to move downward, it forces the pressure-plate downward. The pressure-plate resists this downward movement with a predetermined force sufficient to hold the work-piece or disc flat and to prevent the formation of wrinkles. Once wrinkles start, it is almost impossible to keep them from becoming larger.

The force exerted on the pressure-plate must not be too great, however, or the metal in the work-piece will not be permitted to flow. It will then split or crack. To state the conditions in another way, the force holding the work-piece between the pressure-plate and the draw-ring must

be light enough to permit the metal to slip and flow. But at the same time, the pressure must be great enough to prevent thickening of the metal to the extent that it will buckle or wrinkle.

As the draw-ring and pressure-plate carry the work-piece downward, the work-piece is drawn over the punch. The diameter of the disc is reduced, the metal plastically flowing over the radius of the draw-ring and around the punch. The drawn part is forced out of the draw-ring by the knockout at the completion of the cycle.

A simplified rule for approximating the diameter of the metal disc required to form a given size cup is as follows:

$$D = \sqrt{4dh + d^2}$$

where D = diameter of disc;
d = cup diameter;
h = height of cup.

Basically, this rule states that the area of the disc is equal to the area of the sides of the cup plus the area of the bottom of the cup.

There are several other factors affecting the accuracy of this formula. Among these are the radius or form of the bottom corner of the cup; the clearance between the draw-ring and the punch; the force applied to the pressure-plate; the lubrication of the work-piece; the speed at which the cup is drawn; and the characteristics of the metal being drawn. For irregular shapes, the blank size is often found by cutting out trial blanks by hand.

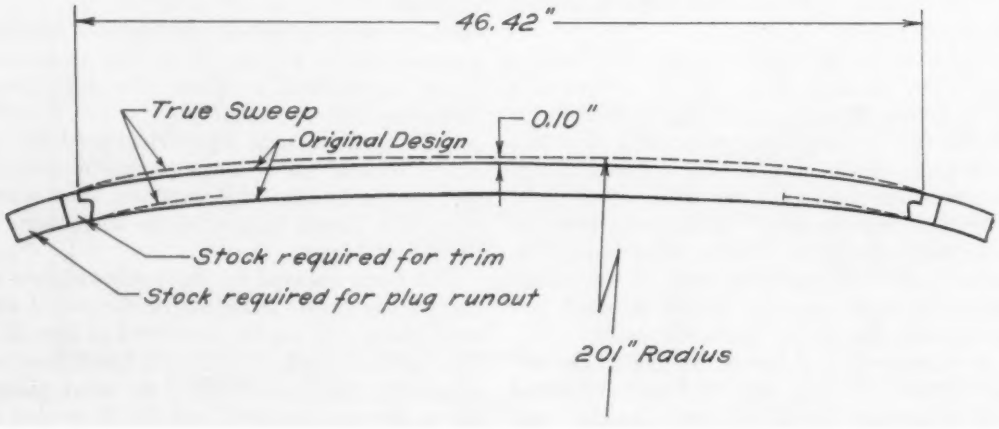
The drawing operation described is performed by a double-acting die in a single-acting press. For larger work-pieces, the same operation is performed with a die in a double-acting press. This arrangement may be easily visualized by inverting Fig. 3. Blanks are placed on the draw-ring which will then be the bottom of the die. The pressure-plate becomes the blank-holder and is actuated by the first ram. In operation, the blank-holder descends and contacts the blank with sufficient pressure to permit it to slip or flow without wrinkling. While the blank is held in this manner between the blank-holder and the draw-ring, the second ram descends. This ram carries the punch and forces the blank into the opening in the draw-ring. At the completion of the cycle, the knockout ejects the drawn part from the draw-ring.

Quite frequently in drawing irregularly shaped parts, the blank will slip or flow too rapidly in certain areas. In this case, a drawing bead is employed to restrict the flow of metal. (A drawing bead is a raised rib on the draw-ring used in conjunction with a corresponding recess machined in the blank-holder.) In drawing, the metal must flow up and over this rib of interference. The length, width, and height of drawing beads vary for different dies and are determined by experience and trial.

Ribs and Flanges Reinforce Stampings

Beads or ribs are often used to reinforce certain areas of panels. Stiffening ribs can greatly increase the strength and rigidity of a part and often reduce the metal thickness requirement. In

Fig. 4. Substantial cost reductions were realized through a minor tolerance concession on this windshield upper garnish molding. Original design had a true radius for all but 4 inches at either end, requiring a secondary bending operation and an extra material allowance. Later design called for true sweep throughout.



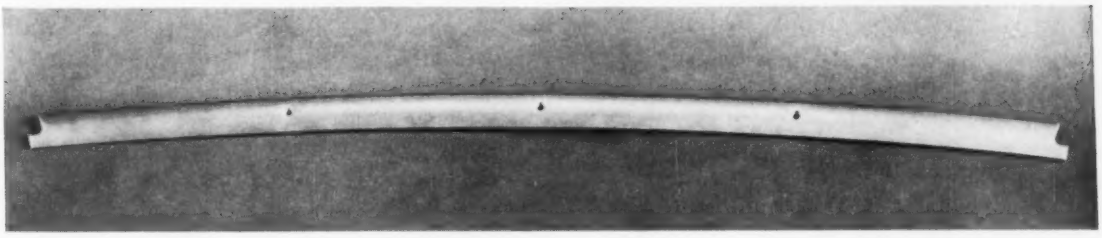


Fig. 5. This is the redesigned garnish molding illustrated in Fig. 4. By utilizing a true sweep along its entire length, the additional bending operation was eliminated and a saving in scrap-material allowance was obtained.

certain cases, reinforcing brackets or braces can be eliminated. An example of this may be found on an automobile instrument panel. (All of the examples that follow describe how Chrysler Corporation resolved various engineering problems related to the forming and drawing of automotive parts.) A bracket was designed to reinforce the tab for a glove-box lock. By forming four ribs (two in the tab and two in the flange) the need for this bracket was eliminated. Fortunately in this case, the change in design was made in time to save the expense of making the dies for the brackets.

Ribs have also been used to locate other panels at assembly. An example of this, the cowl inner side panel, also involves another point of interest —tight and loose tolerance dimensioning. A rib in the panel is used for reinforcing as well as for location. From the part print, the rib had only the appearance of a reinforcement rib and therefore its location was not believed to be too critical. The die was built under this assumption and later had to be revised to correct the position of the rib. In this case it would have been better to hold a closer tolerance. Most part tolerances, however, are held considerably tighter than is necessary to produce a good quality part. Closer or tighter tolerances almost always increase manufacturing costs and in some cases this increase becomes very great.

A comparatively minor tolerance concession produced a substantial manufacturing cost reduction for upper garnish moldings of windshields. This molding was originally designed to have a true, over-all radius or sweep except for the last 4 inches at the ends which deviated by approximately 0.100 inch. To produce these parts as designed, it was necessary to roll-form coil stock with a true sweep and cut it off in lengths longer than required for a finished part. The extra length was required to allow for runout of the bender plugs in the next operation performed in a double-arm bending machine.

The molding design was changed to a true sweep throughout and deviated from the original design by 0.100 inch at the center, as shown in Fig. 4. After suitable changes were made in the mating parts a satisfactory assembly was obtained. This redesign eliminated the bending operation and yielded savings of the extra material previously required to facilitate the bending operation. In addition, by obtaining a true sweep off the rolls, the part, Fig. 5, is held to a close tolerance, thus improving the general appearance of the assembly.

Flanges around openings or on edges of panels are also used for reinforcement. There are many openings on the inside panels of car bodies that are flanged but the necessity of so great a number has been questioned. It is recommended that

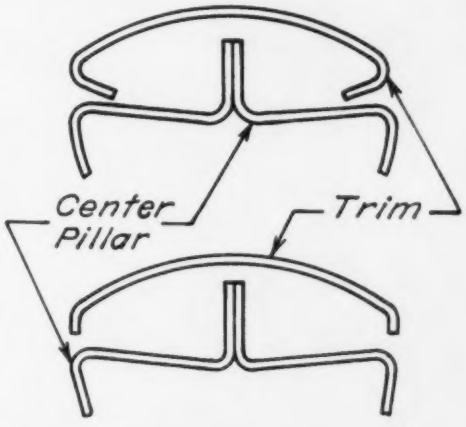


Fig. 6. Parts with flanges on opposite edges that exceed a 90-degree bend (top) require more than one forming operation to prevent locking onto the die. By making these flange bends 90 degrees or less (bottom), they may be formed in one press stroke.

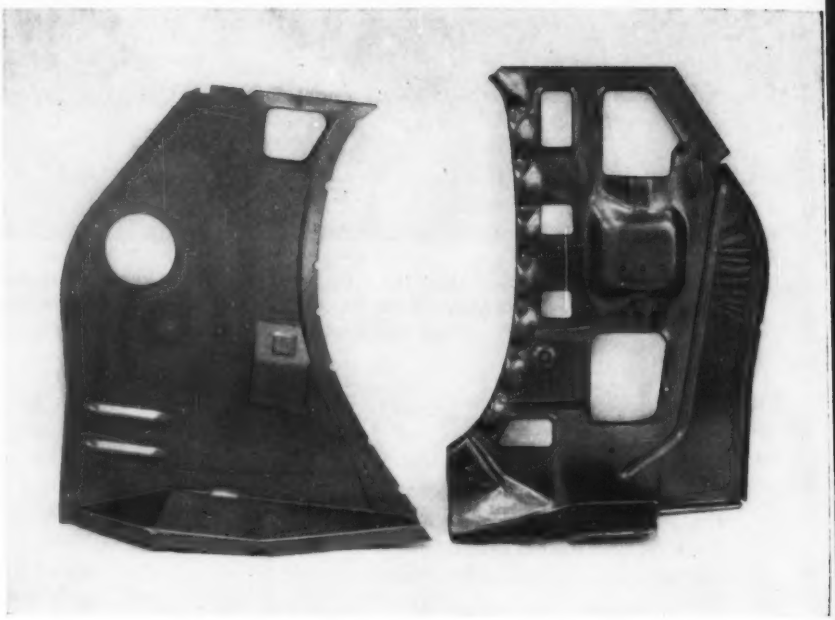


Fig. 7. Two cowl inner side panels are compared. The initial design, right, has many deep-formed pockets, required a greatly over-sized blank, and inherited too many severe wrinkles. A simplified panel, left, served the same purpose but was a simple, straight-flanged part.

flanges be specified only when they are structurally required.

When flanges on opposite edges of a part are 90 degrees or less they are considerably easier to make than those over 90 degrees and may be formed with one press stroke. In addition, the parts may then be removed or ejected from the die without interference. Flanges over 90 degrees on opposite edges of a part often require more than one die operation to prevent wrapping or locking of the part onto the forming die.

An example of redesign involving this principle is the center pillar trim. The trim was previously designed with reverse flanges to locate against the center pillar, as seen at the top in Fig. 6. A recommendation was made to eliminate the re-

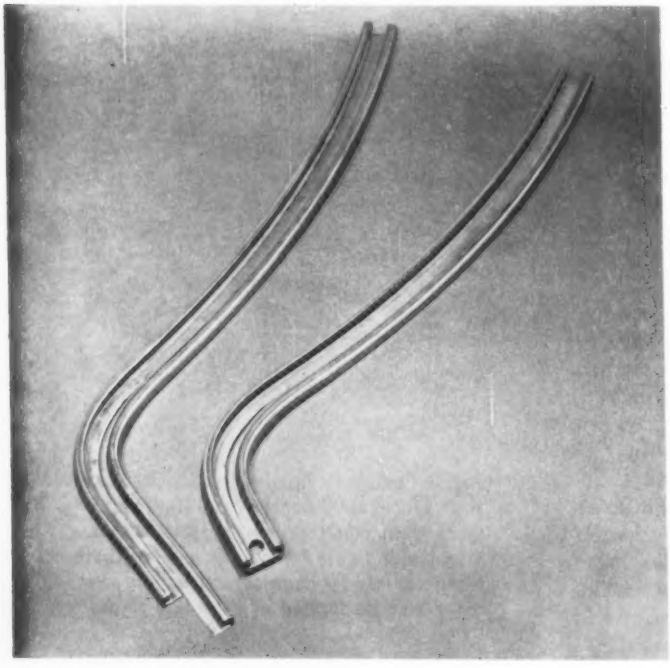


Fig. 8. An example of how compressive and tensile forces react during the bending of a window roller track. The end of the rolled section was cut lengthwise along bend area to allow individual movement of inner and outer sections (left). Trimming and punching complete the part (right).

verse flanges and make a straight flange of 90 degrees or less. By so doing, the part is made as illustrated at the bottom in Fig. 6 with much less difficulty and at a substantial saving.

A body side sill was another closed part which would tend to lock onto the forming die. This part is made by forming in an open condition. In the last step, the part is rounded or closed over a forming die. An engineering concession was required to change the angle of the wire harness trough, permitting easy removal of the part.

The original design of a cowl inner side panel, seen at the right in Fig. 7, is an example of a part with many deep-formed pockets. This stamping was more difficult to produce than a simple straight flanged part. It was visualized that a set of three dies would easily make the simplified part. The number of production dies that would be required to produce the panel as designed by the Engineering Department and made by the prototype section, however, was a matter of speculation.

In order to produce the panel as originally designed, certain concessions and sacrifices would be necessary. These would have a direct bearing on cost and quality standards. First, a greatly oversize blank would have to be used, resulting in excessive scrap. Second, severe wrinkles would occur in the panel. However, this was not considered too detrimental because the panel was not exposed and would be covered at assembly. In addition, the irregular, distorted, and insufficient flange-face areas would result in welding difficulties. After much consideration, a decision was made to produce the simplified panel shown at the left in Fig. 7.

A part known as the quarter-window front roller track (Fig. 8) provides an excellent example of how compression and tensile forces in a bending operation can be reduced. This part is a rolled section which requires a comparatively severe bending. In the operation, the squeezing together of the metal on the inside radius of the bend and the stretching of the metal on the outside radius were so severe that the part could not be formed. To correct this condition, the end of the rolled section was cut lengthwise through the center to allow the inside and outside sections of the part to move individually in bending. During the operation, the outside section of the part is bent in a longer arc and therefore extends a shorter distance beyond the bend. By actual measure the inner half of this part extended 1 1/16 inches further beyond the bend than the outer half. The ends are then trimmed to length, resulting in a part of the original design.

Check List of Ways to Improve the Design of Stampings

1. Make drawing and forming radii as large as possible. This will reduce the tendency of a work-piece to crack, tear, or rupture.
2. Design stampings as "open" as possible to reduce the number of die operations and reduce the tendency of parts to stick in the forming die. Work-pieces that are difficult to load and unload manually will be even more difficult to produce in an automated setup.
3. Omit flanges on access holes if they are not needed structurally. This will reduce the cost of die-building as well as maintenance.
4. If a part is difficult to flange, investigate the possibility of reversing the direction of the flange and changing the mating part.
5. Design parts so that they can be formed rather than drawn.
6. Make drawn sections as shallow as possible.
7. For better material handling investigate part design for the possibility of nesting blanks in the strip or sheet. Also investigate the nesting of formed parts.
8. Specify close tolerances for critical parts or areas and increase tolerances on non-critical dimensions.

Motion Picture of Machine Tool Industry Feature of Spring Meeting

AN educational motion picture produced to acquaint the general public with the relationship between machine tools and employment, between machine tools and our standard of living, and between machine tools and national defense had its première before the members and guests of the National Machine Tool Builders' Association at the Fifty-Seventh Spring Meeting, which was held in Detroit on April 30 and May 1. The movie, entitled "One Hoe for Kalabo," demonstrates the interchangeability of parts, without which mass production would be impossible. It explains what machine tools are and what they do for mankind.

Opening scenes show natives in a tiny village in the interior of Africa digging bog iron ore, smelting it in a primitive furnace to which air is supplied through goat-skin bellows and producing, as the result of a whole day's work, a little chunk of iron from which a single hoe is pounded. This primitive form of manufacture, unchanged in centuries, is then contrasted with today's modern production methods used in building automobiles, typewriters, television sets, electric generators, steel-making equipment, and food-processing machinery; and in fact, in every type of mechanism used in the factory or home. Views of machining operations in various factories are presented so that the work done by machine tools can be seen and readily understood.

Ralph J. Kraut, president of the Association, and president of the Giddings & Lewis Machine Tool Co., made a strong appeal in his address to the Association for a reversal of the wage-price inflation spiral in order to keep America in a competitive position. Mr. Kraut prophesied that unless this spiral is reversed, the United States will lose its place as the leading manufacturing country of the world.

"The American economy generally," Mr. Kraut said, "is pricing itself out of the market." Wage rates abroad are only from one-fourth to one-fifth of ours; and, according to government figures, our wage rates have gone up twice as fast as output per man-hour. Meanwhile, foreign technology, both in equipment and know-how, has caught up with ours. Under these circumstances American manufacturers cannot produce at competitive prices. If this continues, the inevitable result will be more production abroad and less in the United States—until we lose our position as the leading manufacturing nation.

"The machine tool industry is but one example of mushrooming of foreign competition with production costs far below those in the United States. In 1958 England and West Germany each produced more machine tools than we did in this country. Russia is today turning out 120,000 machine tools a year and is shooting at 200,000. This compares to an output, in this country, of 300,000 machine tools in the peak year of World War II, 100,000 in the Korean crisis, and less than 30,000 in 1958. Under the wage-rate differential which exists today, this trend will continue unless corrective action is taken."

Mr. Kraut recommended a four-point program to reverse the wage-price inflationary spiral, as follows:

1. Halt the inflation spiral. Both management and labor must join in holding down costs and increasing productivity and government and the public must also do their share.

2. Governments, at all levels, must aim at balanced budgets, less spending, elimination of give-away programs, etc., with the objective of reducing taxes at all levels to release more venture capital. In particular, there must be a revision of Internal Revenue depreciation policies which are curtailing modernization and have contributed to today's 60 per cent obsolescense factor in America's metalworking plants.

3. As long as the present, extreme wage differential between the United States and foreign countries continues to exist, it is imperative that protection be provided for American industry by embargos, tariffs, or quotas.

4. We must wake up to the fact that our position as the top industrial nation is seriously threatened. It is high time we dropped our complacency and got to work.

N. M. Forsythe, president of the National Automatic Tool Co., Inc., made an impressive appeal for convincing government officials of the necessity of depreciation reform. He pointed out that realistic and adequate depreciation reforms are a *must* if the machine tool industry and the national economy are to prosper in the competitive international business struggle that must be faced. Mr. Forsythe stated that we are in a price war with European competitors who have far more modern facilities than American concerns, and that American industry cannot afford to invest continually in modern equipment without at least

as good charge-off opportunities as are allowed machinery buyers in Europe.

Under Bulletin F, write-off periods for machine tools in the United States vary from 15 to 33 1/3 years. It is possible, by using available options and submitting proper proof to the Internal Revenue Service, to obtain a better write-off, but there are thousands of companies taking an annual 5 per cent write-off. In France, new machines can be written off with a depreciation of 10 to 15 per cent per year; in Sweden, of 20 per cent; in Switzerland, of 25 per cent at a declining balance rate; in Belgium, of 15 per cent; in Denmark, of 10 per cent; in Holland, of 10 per cent; and in Italy, of 15 per cent.

However, some countries have, in addition, special optional allowances that increase the incentive toward modernization. For example, in England, an additional allowance of 30 per cent is permitted in the first year and in France, a double write-off is allowed. In Austria, 40 per cent can be written off the first year, and in Denmark, 33 1/3 per cent. In Italy, if a concern puts up a new plant, the depreciation period is reduced two-fifths. In Germany, within certain limitations, 50 per cent may be written off in the first two years, while in Portugal, 60 to 100 per cent can be written off in the first four years. In India, a company installing machines in a new plant can write off 125 per cent of the cost. Finally, in Canada, machine tools as a category have a depreciation rate of 20 per cent annually.

Mr. Forsythe referred to the fact that the Association's position on depreciation is to advocate a bracket similar to that used in Canada, and/or combined with a system of substantial first-year allowance such as is used in England; also with the concept of shorter lives. This concept is universal throughout the world with the exception of the United States.

Donald H. McIver, vice-president in charge of industrial sales, Ex-Cell-O Corporation, and chairman of the 1960 Machine Tool Exposition Committee, heralded the coming exposition as the event that will really launch our economy into the next decade. Mr. McIver looks upon the exposition as a great educational project because it will constitute a working exhibit of the latest advances in the art of the cutting and shaping of metal. The exposition will open the day after Labor Day, 1960. Mr. McIver's address explained in considerable detail some of the problems involved in planning such a big event and the difficulties that must be overcome in installing large machine tools.

Chester B. Lund, director, Field Administration, Department of Health, Education, and Welfare, Washington, D. C., discussed the "Tools for Schools" program of his department. He mentioned that a total of 7500 machine tools were allocated to schools in 1958. This year, up to March 31, 2505 machine tools were allocated, an increase of 35 per cent over the last quarter of 1958. These figures include only the major categories of metalworking machines. In addition, there were large numbers of portable tools, power-driven hand tools, attachments, accessories, measuring and testing equipment, woodworking machines, raw materials, and so on.

Virgil B. Day, manager, Public Affairs Service, General Electric Co., stated that American industry last year spent nearly one billion dollars on employe communication alone. For communication with customers, community neighbors, venders, distribution people, and representatives in government, a much higher figure would be conservative. Mr. Day questioned whether the vast outpouring of words, pictures, and symbols in public relations has generally won for business men the understanding, approval, and support of those to whom it was directed. He presented a thought-provoking challenge for business men.

Alphons J. John, manager–employe and community relations, Kearney & Trecker Corporation, gave a talk entitled, "In Community There is Strength," which dealt with community relations. As Mr. John explained, that is the phase of public education in which industry seeks to promote and achieve, on an enduring basis, mutual understanding between management and employes and a feeling of goodwill on the part of the public toward companies in the communities where they are established. He said that community relations are a management responsibility, that is, the function of every member of the top management team.

Brigadier General Joseph M. Colby, Deputy Commanding General, U. S. Army Ordnance Missile Command, Huntsville, Ala., paid tribute to the cooperation of the machine tool building industry with government services down through the years. He expressed the opinion that all departments of government have a more sustained appreciation than ever before in our history of the basic contributions of the machine tool industry to National Defense and peacetime economy. He said that the close relationship between the machine tool industry and Army Ordnance has contributed immeasurably to our military-industrial programs and provides a firm basis for meeting any challenge of the future.

Addresses were also made by Hugh C. Hoffman, vice-president, Opinion Research Corporation, whose subject was "Educating the Public to Political Realities," and Niels A. Olsen, director, Metalworking Equipment Division, Business and Defense Services Administration, who gave a report about his division.

Fabricating Machinery Hydraulics Conference

The third Fabricating Machinery Hydraulics Conference sponsored by Vickers Incorporated was held at the Sheraton-Cadillac Hotel, Detroit, Mich., on April 28 and 29. Hydraulic products, system designs, and maintenance methods of concern to fabricating machinery builders and users were discussed by about 175 representatives of more than seventy-five firms. Most of the program was devoted to audience participation in discussions and the free exchange of ideas and experiences. Also, six technical papers were presented.

Moderators for the conference were Fred Dahlman, development associate, Corning Glass Works—who represented the machinery users—and Robert J. Erskine, supervisor of engineering, the Wean Engineering Co., Inc.—representing the machinery builders. The keynote speaker was Paul Rolnick, editor of *Applied Hydraulics and Pneumatics*.

George C. Bonnell, service manager of the Machinery Hydraulics Division of Vickers, presented a paper, "A Realistic Look at Hydraulic Maintenance." He pointed out that industry is spending upwards of eleven billion dollars a year for maintenance, and recommended the following steps to reduce this expenditure:

1. Train personnel to recognize signs of possible hydraulic trouble and take corrective action.
2. See that all reports of potential trouble are investigated and corrective action is taken immediately.
3. Analyze reports periodically, and keep a record of major breakdowns to find areas needing special attention.

William Bayley, process engineer, AC Spark Plug Division, General Motors Corporation, presented a color film illustrating the final assembly of spark plugs, explained the operations performed, and discussed the hydraulic components employed. Harrison Munro, hydraulic and electrical engineer, Pines Engineering Co., described his company's new machine for bending thin-wall aircraft tubing up to 8 inches in diameter. The machine is equipped with motorized flow-control valves. B. A. Olmsted, chief product engineer, Plastics Division, Package Machinery Co., presented a paper, "Fail-Safe Safety Circuit on an Injection Molding Machine." Mr. Olmsted outlined the use of limit switches, solenoid-operated valves, limit-switch-controlled valves, and interlocks as safety features on such machines.

Richard L. Leslie, supervisor of the Fluids Laboratory at Vickers, spoke on "Managements' Considerations in the Selection of Fire-Resistant Fluids." Mr. Leslie mentioned the following points that should be considered in selecting fire-resistant fluids: the degree of fire resistance, compatibility of the fluid with system-component materials, operating characteristics of the system, leakage rate of the system, and the effect the fluid will have on the operation and maintenance of the system components.

R. G. Spencer, assistant chief engineer of the servo-systems section, and R. J. Render, staff supervisor of electrohydraulics systems—both of the Machinery Hydraulics Division of Vickers—presented a paper entitled "Analyzing Your Need for an Electrohydraulic Control System." It was pointed out that the primary advantages of servo control are flexibility, accuracy, and control of dynamics. Other possible benefits include reduced tooling, reduction of setup time, and better quality control.

In that portion of the conference agenda devoted to directional control valves, the need was cited for values of pressure drops. A Vickers representative pointed out that it was difficult to provide such values in convenient form since they would vary with the type and viscosity of the fluid to be used, the operating temperature, the flow rate, and other factors. In the discussion on fluids, it was emphasized that complete draining of the system was essential before using fire-resistant fluids, to prevent the possible mixing of fluids.

As in previous conferences, a spirited discussion was held with regard to leakage control in hydraulic circuits and systems. Specific recommendations made to reduce leakage included: the use of as low a pressure as possible, minimizing of shock, the use of gasket-mounted sub-plates or flanged connections, keeping fluid temperature as low as possible, developing good maintenance habits, proper installation (including accurate alignment, protection from foreign material, minimum number of joints, ample supports, and convenient location), and the use of SAE straight threads and O-rings.

In the discussion on accessories, a Vickers representative suggested the use of a 10-micron filter when using industrial servo valves, and stated that the filters should be as close to the valves as possible. A representative of a fluid supplier added that his company did not recommend using a filter of less than 20 microns with emulsion type fluids since the additives might be removed too rapidly. However, he added that this problem is not too serious with newer fluids and a relatively clean system.

MACHINERY'S PROBLEM CLINIC

Mathematical problems in shop work and tool design submitted by readers of MACHINERY

Edited by HENRY H. RYFFEL

Solution by Successive Approximations Avoids a Fourth-Degree Equation

W. W. JOHNSON, Cleveland, Ohio

In the design of a machine it was necessary to determine angle A established by the dimensions shown in Fig. 1. This was done with the aid of Fig. 2 as follows.

SOLUTION:

1. $x = 3.2 \tan A$
2. $h = 2.50 - 1.75 = 0.75$
3. $x = 2.5 \cos A - 0.75$

From (1) and (3),

4. $2.5 \cos A - 3.2 \tan A = 0.75$

An algebraic solution of (4) would involve an equation of the fourth degree. To avoid solving such an equation a method of successive approximations can be applied to (4) as follows:

For a first approximation let $A = 25$ degrees. Then from (4),

5. $2.5\ (0.90631) - 3.2\ (0.46631) = 0.77359 > 0.75$

Try 26 degrees:

6. $2.5\ (0.89879) - 3.2\ (0.48773) = 0.68624 < 0.75$

Thus, the angle A lies between 25 and 26 degrees and by making a proportion of these results and reducing to minutes,

7. $$A = 26° - \frac{0.75 - 0.68624}{0.77359 - 0.68624} \times 60'$$
$$= 26° - 43.8' = 25°\ 16.2' = 25°16'12''$$

Taking this last value of A and substituting in (4),

8. $2.5\ (0.90431) - 3.2\ (0.47206) = 0.75019 > 0.75$

Interpolating again between the difference of 25°16'12" and 25° after first reducing this difference to 972 seconds,

9. $$A = 25° + \frac{0.77359 - 0.75}{0.77359 - 0.75019} \times 972''$$
$$= 25° + 980'' = 25°\ 16'\ 20''$$

Checking in (4),

10. $2.5\ (0.90429) - 3.2\ (0.47211) = 0.74997$ which is very nearly 0.75

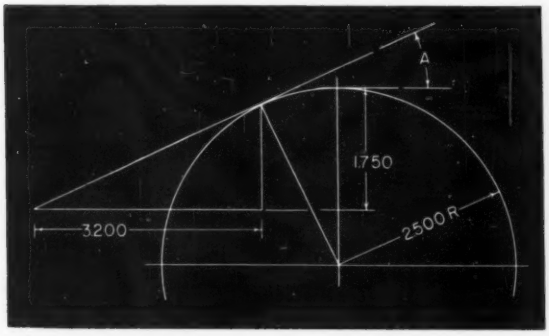


Fig. 1. The solution for unknown angle (A) depends upon the dimensions shown.

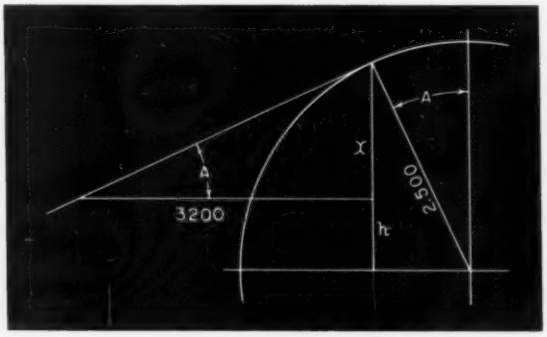


Fig. 2. The solution for angle (A) in Steps 1 to 10 is based on this diagram.

LATEST DEVELOPMENTS

Machine tools, unit mechanisms, machine parts, and

Clearing-Axelson "Blue Chip Lathe"

The metal-cutting capacity and rigidity of a new type of engine lathe were demonstrated at a press party given recently by the Clearing Division of U. S. Industries, Inc., Chicago, Ill. The machine, known as the Clearing-Axelson "Blue Chip Lathe" Model 2516, is shown in Figs. 1 and 3. It has a swing of 25 inches over the ways and 16 inches over the cross-slide. Although available with a bed of any desired length, the machine demonstrated had an over-all length of 16 feet.

The strength and rigidity of this lathe was evident from the fact that the bed and headstock did not flex more than 0.0001 inch when one end of the machine was picked up by a crane and returned to the floor repeatedly. This rigidity is made possible by the welded-steel construction of the bed and headstock.

To further demonstrate the strength and rigidity of the lathe, one end was raised a foot above the floor while the other remained on the floor, both ends being left free—not fastened to the floor. A forging of SAE 1045 steel 7 1/2 inches in diameter by about 2 1/2 feet in length was then turned. This forging retained the mill scale surface and had a hardness rating of 240 Brinell. With the lathe in the tilted position a roughing cut 5/16 inch deep at a feed of 0.35 inch per revolution was taken the full length of the forging at a surface cutting speed of 300 feet per minute. The variation in the diameter of the workpiece after removing the tough scale with this roughing cut was only 0.002 inch.

A finishing cut was then taken at a speed of 158 rpm while one end of the lathe bed was raised a foot above the floor. The depth of cut for this operation was 3/4 inch and the feed, 0.035 inch per revolution of the work. The variation in the diameter of the work after this turning operation was only 0.002 inch.

Two models of the Clearing-Axelson "Blue Chip Lathes" are available—the Model 2516 shown in the accompanying illustrations and Model 2013, of smaller size, which has a swing of 20 inches over the ways and 13 inches over the cross-slide.

The basic weights of these machines with 10-foot beds are 10,300 and 12,000 pounds. Each 2 feet of bed length added to the smaller lathe increases its weight 700 pounds and each 2 feet added to the larger model serves to increase its weight about 900 pounds.

Both lathes have forty spindle

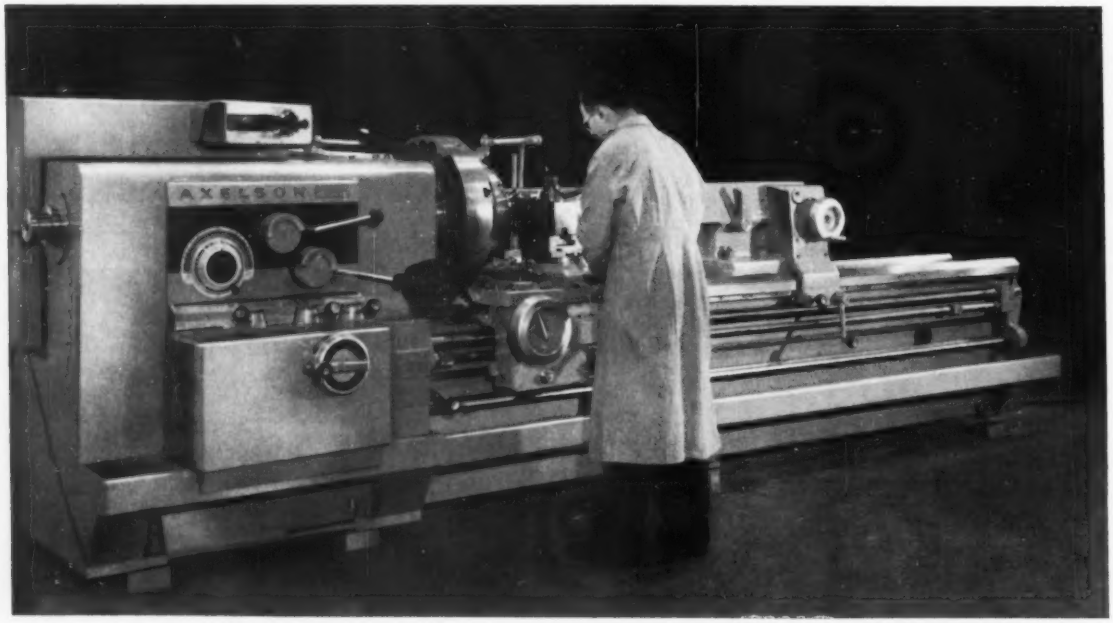


Fig. 1. Clearing-Axelson Model 2516 "Blue Chip Lathe" of welded-steel construction

IN SHOP EQUIPMENT

material-handling appliances recently introduced

Edited by FREEMAN C. DUSTON

speeds, forward and reverse. The low range is from 8 to 1200 rpm; medium range, 11 to 1600 rpm; and high range, 14 to 2000 rpm. Eighty-eight quick-change feeds are available on each machine. The standard feed range is from 0.0027 to 0.170 inch per revolution of the spindle. The special range is from 0.0011 to 0.068 inch per revolution. There are also eighty-eight quick changes for thread cutting ranging from 1 1/2 to 92 threads per inch.

Motor-to-headstock drive is by steel cable V-belt. A 25-hp motor having a speed of 1800 rpm is standard for the smaller lathe but a 20-hp motor with a speed of 1200 rpm is available. The larger machine is equipped with a 40-hp motor having a speed of 1800 rpm as standard. A special 40-hp motor with a speed of either 900 or 1200 rpm can be furnished. A 50-hp motor with a speed of 1800 rpm is also available. The tailstock is of a two-speed type.

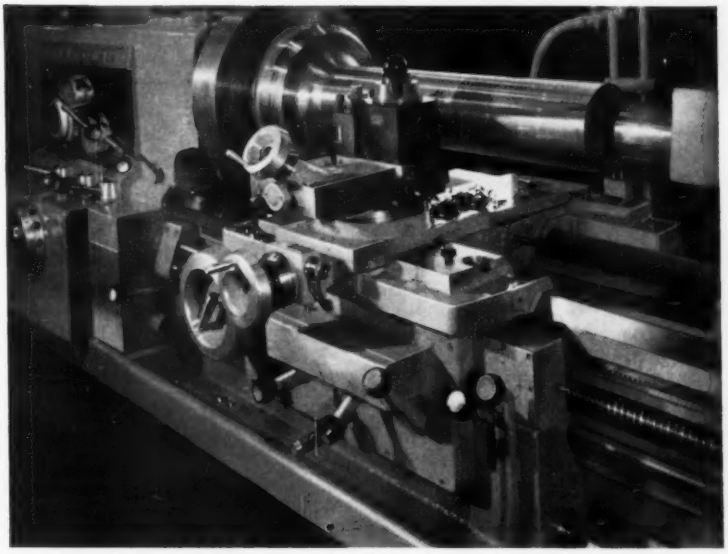


Fig. 2. Close-up of carriage of lathe shown in Fig. 1, taking a cut with a carbide tool

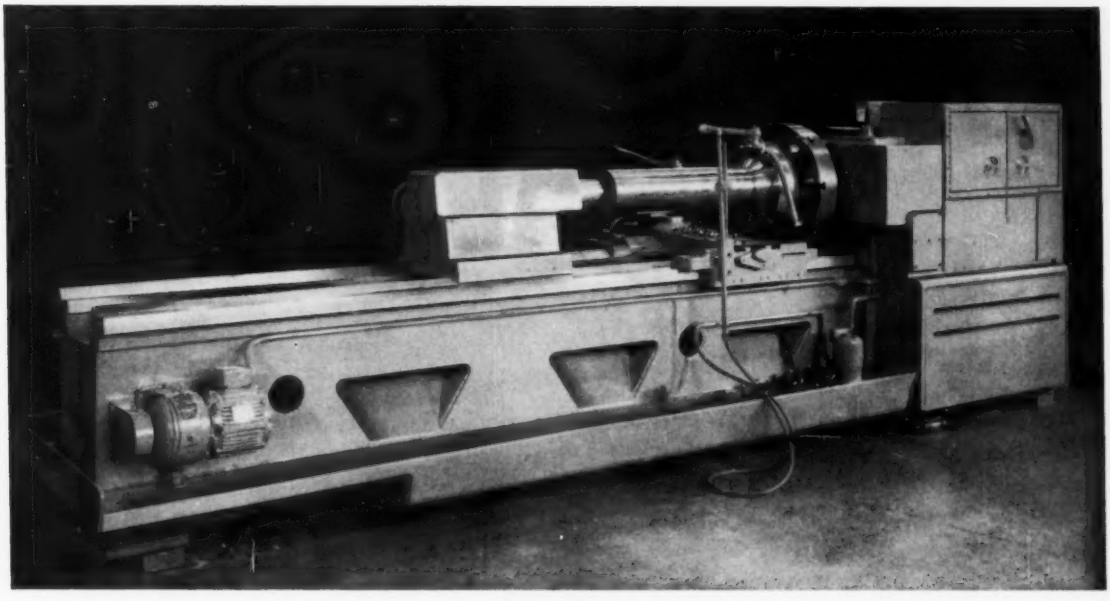


Fig. 3. Rear view of Clearing-Axelson Model 2516 lathe

Standard equipment on both models includes two-way powered rapid traverse; micrometer cross-feed threading stops; horsepower meter; speed–feed calculator; and integral chip pans along front and rear of lathe bed.

One of the outstanding features of these lathes is their building-block type of construction. The headstock, which contains the drive and the operating controls, is built as a separate unit so that it extends to the floor. It also supports the operating console and other devices. The bed is mounted to the side of the headstock by a thick, extra-wide flange. Any future need for a bed of greater length—or completely different design—can be met by assembling the existing headstock to the new bed.

Weldment construction made it possible to design the entire bed with continuous reinforcement from end to end. The front wall of the bed, which takes most of the force of the cutting loads, has been extended all the way to the floor. The chip pan, as shown in Fig. 1, has been designed to add strength to the entire structure. Ribs are placed inside so that a series of pyramid shapes—structures of immense stiffness in themselves—are formed. These reinforcing ribs also serve as the wall of the chip-disposal chutes in the bed as may be seen in the rear view of the lathe, Fig. 3.

"Unitizing" has been carried out on every major component of the headstock. Drive gearing, quick-change gear-box, and electrical equipment—each may be removed as a unit to simplify servicing.

Standard gear shifting is manual, with a four-position and a five-position lever operating in two ranges. However, power-assisted and full-power shifting are available as options. The rotary slide rule picks the right code for speed changing. Moving two levers causes the spindle to rotate at the selected speed. Spindle-speed levers are color-coded in orange. Feed-change levers are color-coded in yellow.

Circle Item 565 on postcard, page 193

Landis Multiple-Wheel Cylindrical Grinder for Processing Crankshaft Bearings

An improved, multiple-wheel precision grinding machine, designated the Landis Type IWR, has been developed by the Landis Tool Co., Waynesboro, Pa. This equipment will grind two or more concentric diameters to extremely close tolerances on a production basis. It is available for complete automation or semi-automatic operation and is made in 10- and 14-inch swing sizes with a 30-inch length between centers. The grinding wheels regularly employed are 36 inches in diameter. Either 36- or 42-inch wheels are available on

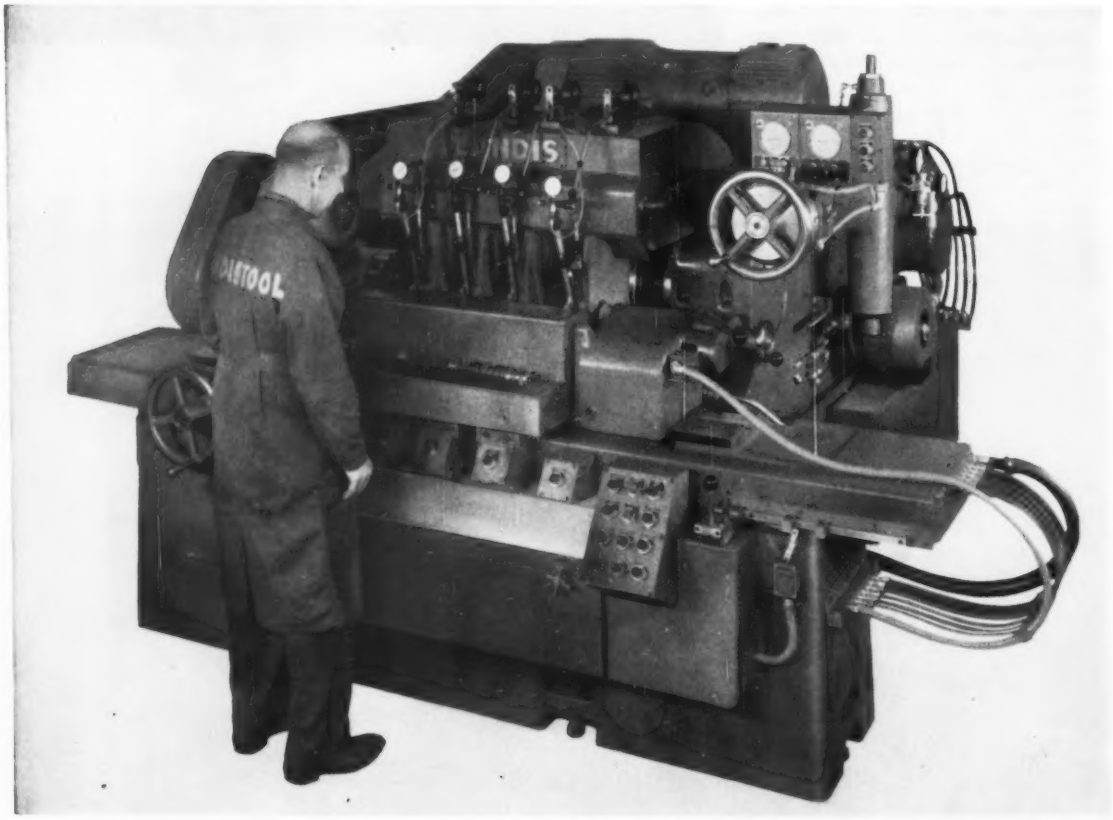


Fig. 1. Landis multiple-wheel hydraulic grinding machine tooled for grinding four main bearings of a camshaft

the 14-inch machine. Line bearings on work-pieces such as crankshafts and camshafts, transmission shafts, and components of jet engines can be ground to precision limits on these machines. Bearings with either straight or cylindrical surfaces, as well as profiled designs, can be ground to the required diameters. The 10-inch machine shown in Fig. 1 is equipped to remove 0.015 inch of stock from each bearing of a camshaft at the rate of sixty-five camshafts per hour.

New concepts in grinding feeds, diamond dressing of the wheels, and temperature control of the machine are said to make it possible to grind multiple-diameter work to closer tolerances than previously thought possible. Setup time is also reduced substantially and scrap is practically eliminated. All hydraulic controls on this unit are mounted on a panel away from the bed. Hydraulic oil and coolant reservoirs are in separate tanks outside of the bed. Only the feed and traverse cylinders are within the machine. Coolant drains immediately from the wheel guard to its reservoir. This design keeps the machine at room temperature, thus minimizing possible inaccuracies in the machine alignment.

A newly developed "Microfeed" wheel-feed system is being introduced on this multiple-wheel grinder. This feeding system is claimed to be an advance in precision grinding accuracy. Its outstanding feature is its ability to duplicate its feeding action on successive work-pieces continuously. It will feed the grinding wheels in increments as small as 50 millionths of an inch. The feed automatically compensates for all variables which may be introduced by deflections of machine parts from grinding forces; variations due to minor temperature changes; changes in wheel characteristics due to grinding and dressing; and variations in feed rates due to temperature changes in the hydraulic oil.

The grinding wheels are dressed from individual diamond holders which are mounted on the sliding table at the front of the machine. This method assures dressing the wheel faces parallel to the work center line. It eliminates taper which can develop from temperature changes of the grinding wheel-head and spindle bearings. Diamonds can be advanced by push-button control in increments as small as 50 millionths of an inch. Each diamond can be moved individually, or they can all be moved simultaneously the same amount. Profile bars are easily accessible and fully adjustable.

A new idea in work-rest design is used on these machines, as seen in the close-up view, Fig. 2. The shoes are automatically advanced through sliding tapered blocks. This causes the shoes to follow the work diameter as it is reduced in size and prevents the shoes from backing up due to grinding forces. Once set, the work-rest will always duplicate its action and position. The footstock is provided with a pre-loaded ball sleeve for the spindle. The user is thus assured of always having a shake-proof footstock spindle.

Circle Item 566 on postcard, page 193

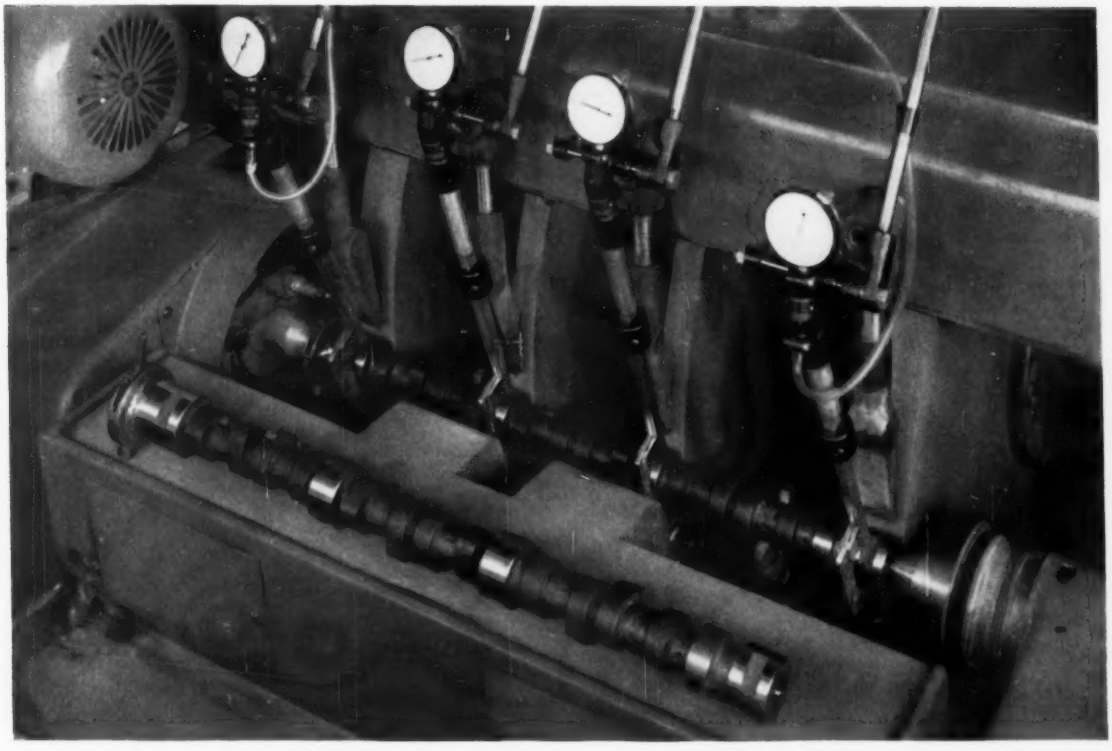


Fig. 2. Close-up of hydraulically operated work-rests, finished work-piece, and work-piece being processed on Landis machine shown in Fig. 1

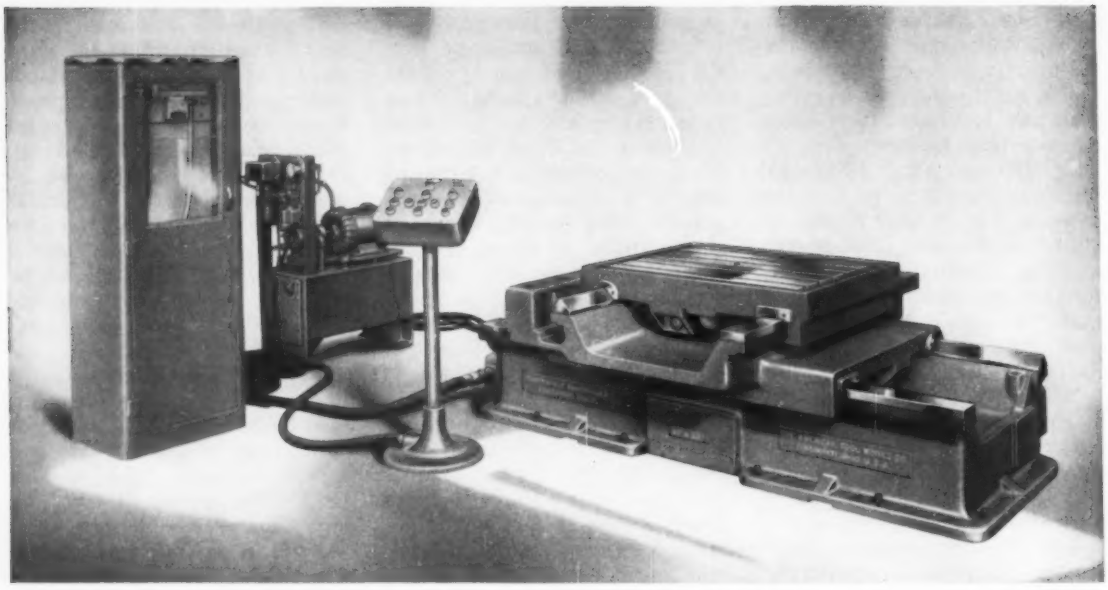


Fig. 1. Tape-controlled positioning table and equipment announced by the American Tool Works Co.

Tape-Controlled Precision Positioning Table for Heavy-Duty Production Drilling and Boring Jobs

A positioning table designed for accuracy equal to that of the finest jig-borer has been developed by the American Tool Works Co., Cincinnati, Ohio. It is suited for application to both short- and long-run, heavy-duty production drilling and boring jobs, and is numerically controlled by an endless punched tape. The 8000-pound table can support and position heavy work-pieces anywhere within a 30- by 20-inch working area with an accuracy of ± 0.000250 inch (non-accumulative) on either axis, or repeat a position within ± 50 millionths inch (0.000050 inch). It is claimed that these accuracies will be maintained even when the table is installed in the shop. Fig. 1 shows (left to right): air-pressurized, tape-control system electronic cabinet; hydraulic-system pumping and valving unit; operator's control panel on portable stand; and the heavy-duty table assembly incorporating ruggedly contructed base, saddle, and table units.

Positioning of the table does not depend upon the skill of the operator and is accomplished quickly without the use of set stops or dials. The table travels automatically from one position to next, moving simultaneously on both axes ("x" and "y") at the same speed from start to finish of movement—yet with no over-travel. Actuation is entirely hydraulic, eliminating traversing screws and motors. Because the hydraulic actuating cylinders are in a balanced closed circuit, the table is rigidly held in position when the pistons are at rest. There are no clamps to cause shifting of table.

The table, controlled by endless

Fig. 2. Tape-controlled positioning table and Hole Wizard radial drill, set up for processing column caps for radial drills

punched tape, is ideally suited for large or small job-lot runs. As soon as one work-piece is completed, the machine is ready for the next without re-threading of the tape.

The complete tape-control system is housed in a pressurized cabinet, shown at the left in Fig. 1. This cabinet is designed to keep out shop dust and dirt. The operator's control panel, mounted on a separate stand as shown, can be moved about for maximum convenience. A punched tape can be readily installed in the control-system cabinet in a few seconds. The tape may be inserted under the reading unit in any position. The control unit then automatically locates the tape in the "start" position which causes the table to move to the extreme front of the machine. This permits the operator to load and unload his work-piece with a hoist, if necessary.

During operation, the punched tape is read pneumatically by a flow of low-pressure air. This air, passing through the holes in the tape, actuates a selected series of switches. The switches signal the electronic control system, indicating the movements the positioning table must make (in terms of "x" and "y") to arrive at the next working location. The electronic circuits then actuate the machine's hydraulic system to perform the required travel movements.

Feedback signals—which tell the electronic system (product of the Sperry Gyroscope Co.) where the table is presently located and announce its arrival at the new position—are supplied by two Farrand electronic scales; one each on the "x" and "y" coordinates. Each scale is made of glass and is read by a slider which maintains a 0.005-inch air space between it and the scale surface to prevent wear. The electronic scales are located in two hermetically sealed housings.

Each position recorded on the punched tape includes: (a) the "x" axis location; (b) the "y" axis location; and (c) special instructions. These three items of positioning information are picked up simultaneously by the tape reader. The punched tape travels only from position to position as the machine work cycle progresses. This makes it possible, by simply pushing two buttons, to repeatedly move out of position and back again to permit gaging a bore.

During loading of the machine, work-pieces are located on the positioning table by means of stop-plates, installed at the edges of the table. By using blocks of prescribed length between these stop-plates and the work-piece, the operator can easily locate the work. Block lengths are prescribed by the man who makes the tape.

A typical setup of the positioning table on a Hole Wizard radial drill in the manufacturer's own plant is shown in Fig. 2. The drilling, boring, counterboring, reaming, tapping, and spot-facing operations on ductile-iron column caps are performed in this setup in only 1 3/4 hours floor-to-floor time. This equalled the best time previously obtained on a radial drill equipped with a costly fixture. Employing a regular boring machine this job required seven hours. The tape-controlled positioning table and Hole Wizard radial drill, Fig. 2, both products of the American Tool Works Co., maintain a maximum bore-spacing error of only 0.0005 inch in routine production of the column caps.

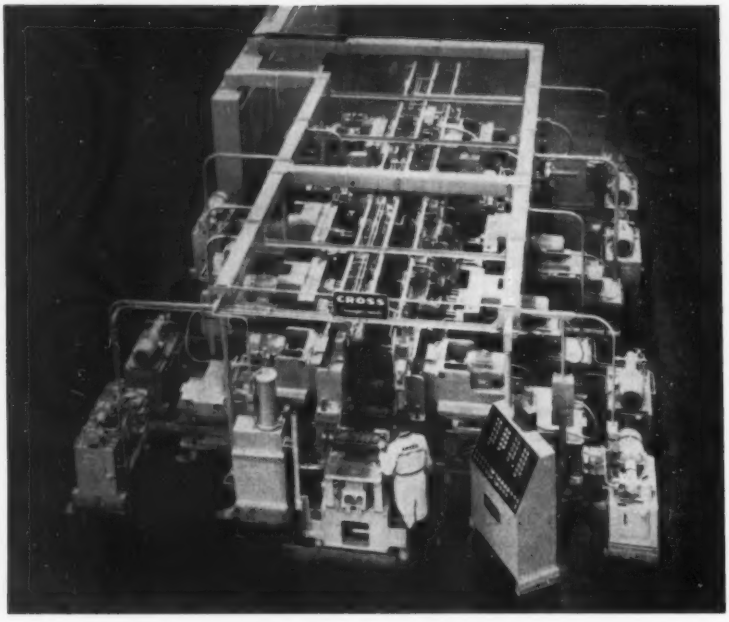
Circle Item 567 on postcard, page 193

Thread-Chaser Grinding Machine

A Reishauer BS thread-chaser grinding machine has been introduced in the United States by the Cosa Corporation, New York City. It is specially designed for grinding all types of flat threads and grooved profiles such as those found on chaser dies, flat rolling dies, racks, etc. The rigid construction of this machine is said to assure extremely accurate profiles and excellent surface finish, making it particularly suitable for mass production.

The unit operates exclusively with multiple-ribbed grinding wheels up to 4 inches in width Grinding-wheel profiling is done by means of hydraulically controlled profile crushing. Feed or infeed is performed by horizontal movements of the grinding wheel slide. The work-piece table is inclined at an angle of 30 degrees from the horizontal. A wide range of work-table speeds is controlled by a variable, hydraulic delivery pump. For setting the required

Reishauer thread-chaser grinding machine introduced by Cosa Corporation



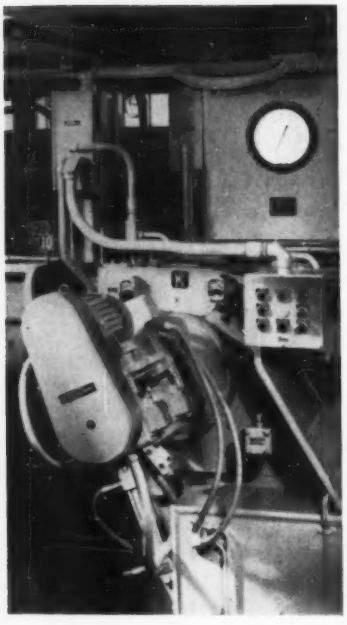


Fig. 1. (Left) Transfer-matic built by Cross Company to process three different diesel-engine cylinder heads.
Fig. 2. (Right) Drill unit of machine in Fig. 1 which swivels automatically from center line of one hole to another for chamfering two oil-gallery holes without reorienting work-piece

pitch angle in grinding radial chaser dies, the work-table can be swiveled plus or minus 6 degrees in either direction. To grind the desired taper in radial dies, the table can also be tilted by plus or minus 6 degrees relative to the grinding spindle axis. A special indexing device also makes it possible to grind work-piece surfaces of a regular polygon shape such as broaches to a maximum length of 14 inches.

Circle Item 568 on postcard, page 193

Cross Transfer-matic for Processing Cast-Iron and Aluminum Cylinder Heads of Various Sizes

A Transfer-matic for machining the ends of two-, three-, and four-cylinder, cast-iron heads for two-cycle, in-line diesel engines, designed to provide a high degree of production versatility and adaptability, has been built by The Cross Co., Detroit, Mich. In addition to processing three different sizes of cast-iron heads, this machine, Fig. 1, will also handle aluminum heads. Output ranges from thirty-eight to forty-four heads per hour at 100 per cent efficiency depending on the size of the head being processed and optional method employed for deep-hole drilling at several stations. In addition to face-milling water-outlet pads and oil- and fuel-hole bosses on three planes, the machine drills, chamfers, and taps all oil, fuel, and screw holes, and air-tests the part for density.

Versatility—the ability to process the three different size heads—results from the adaptability of machine units, fixtures, and components that are quickly repositioned, as required, for processing a batch of any given head design. The heads being processed through the single Transfer-matic range in length from 12 inches on the two-cylinder head, 18.6 inches on the three-cylinder head, to 24 inches on the four-cylinder head.

Machine setup for processing any given head is accomplished within four hours, primarily by the relocation of fixtures and machine units. Relocation is accomplished by tie-rods that connect the fixture to the machine unit. The unit is then advanced or withdrawn to position the fixtures so that they will accommodate the head to be processed. When in position, dowel-pins are inserted manually into locating holes on each side of the fixture base to locate the fixture on its own hardened and ground ways.

For a single machine unit, the operator follows this procedure: advance head to full forward position (positive stop); couple connecting-rods on the head to each side of the fixture by dowel-pins; retract head, pulling fixture to maximum opening and disconnect connecting-rods, and run machine unit back to rear positive stop; make alterations needed in location of machine unit's forward stops and reconnect head and fixture; run head with fixture forward to stop; and remove dowel-pins from connecting-rods and insert them through holes in fixture base into locating holes in top of fixture way and replace connecting-rods in rest bracket.

At several stations employing single-spindle drill units, air-test mechanism or tap heads, fixtures are repositioned by a manually controlled hydraulic cylinder. In addition to minor changes in feed dogs, several tool changes required

to convert the machine from processing any given head complete the change-over.

A novel application of two Cross single-spindle quill type drill units like the one shown in Fig. 2 are used to chamfer two oil-gallery holes at Station 12 without reorienting the part. Each drill unit is mounted on a revolving drum plate that "swivels" the unit automatically from the center line of one hole to the other. After chamfering the first hole, the quill retracts and the unit is revolved by a hydraulic cylinder until the spindle is in perfect alignment with the center line of the second hole. This method was made possible by the cycle time in drilling oil-gallery holes in preceding stations. Either method used for these drilling operations—"woodpecker" or continuous feed drilling—takes longer than the time required by the single-spindle units to chamfer both holes.

Circle Item 569 on postcard, page 193

Gisholt Balancing Equipment for Miniature High-Speed Rotating Parts

One of the big problems of the Space Age, that of eliminating vibration from miniature, high-speed rotating parts, or assemblies containing such parts, has been solved by precision balancing equipment developed by the Gisholt Machine Co., Madison, Wis. Operation of this high-speed balancing equipment, some of which is shown in Fig. 1, has been so simplified that it can be used by an average high school student to balance such vital parts of a missile as the electrically self-driven gyro, Fig. 2. This two-pole, three-phase missile gyro is self-driven at 12,000 rpm. The standard paper clip shown below the gyro gives a good idea of the size of this part. Similar gyros, weighing only 0.72 ounce with correction planes only 1/4 inch apart, have been handled successfully on HS balancer setups similar to the one illustrated in Fig. 1.

The Gisholt HS-1 balancer setup, Fig. 1, used to balance the missile gyro, Fig. 2, has an optional photocell located below the work-piece to measure the angle of unbalance in relation to a single reference line on the rotor. Meters shown at the top right, Fig. 1, indicate the angular position and amount of unbalance. The expanded scale tachometer, lower right, indicates rotational speed. Corrections are made on the drill press, shown at left. A close-up of the drill and work on a similar drill press is shown in Fig. 3. Drill corrections are made in two planes with 360-degree protractor used to speed angular orientation. The dial indicator is used to control drill depth. A suction device removes the chips.

This line of high-speed, bench type balancers has been specifically designed to handle miniature belt-, air-, or electrically self-driven parts

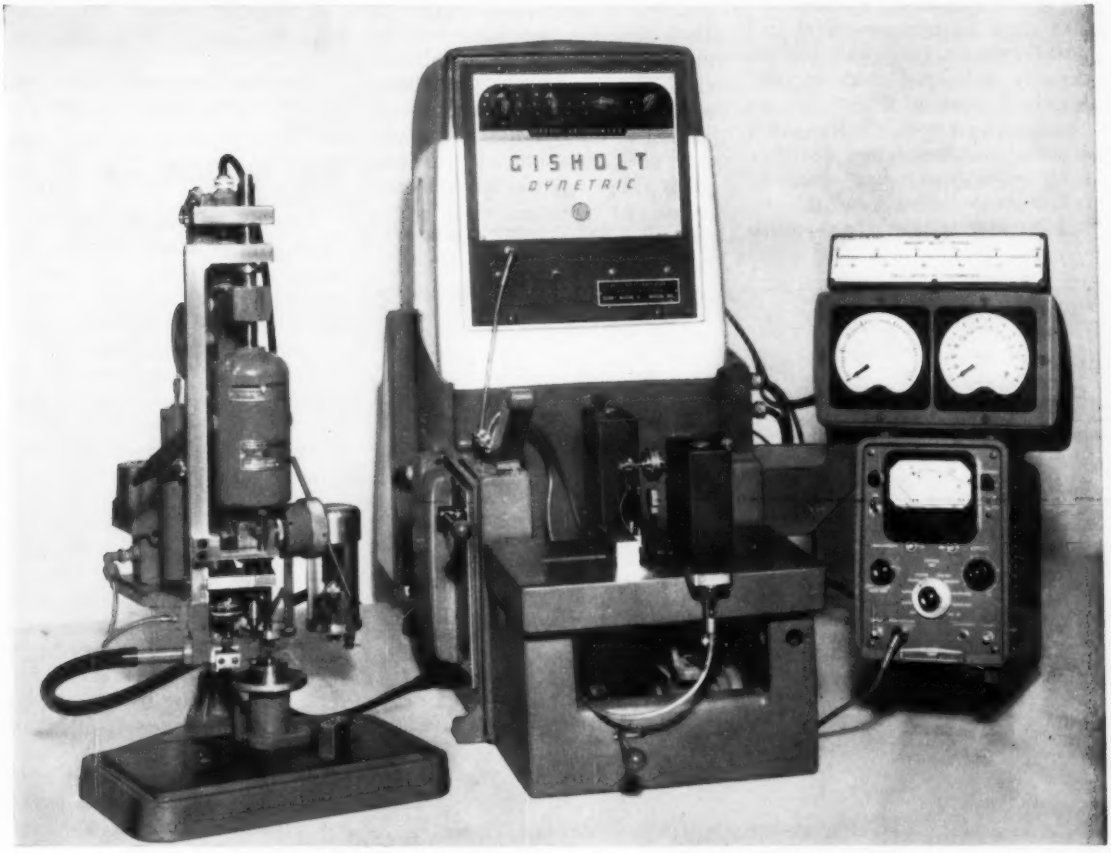


Fig. 1. High-speed balancing equipment developed by Gisholt Machine Co.

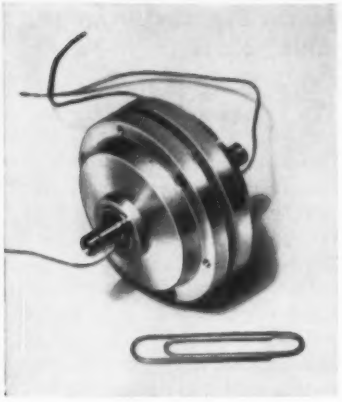


Fig. 2. Electrically driven missile gyro balanced by equipment in Fig. 1

or assemblies. Typical work includes miniature armatures, aircraft and missile gyros, small spindles, turbines, etc. Both horizontal and vertical models are available.

Unbalances causing work support movements greater than 0.000002 inch, with the work rotating at any speed between 1000 and 3000 rpm or between 4000 and 12,000 rpm, can be quickly and accurately measured and located. Standard equipment includes an amplifier, a direct-reading, amount-of-unbalance meter, and a strobe-lamp assembly to indicate angle of unbalance. Supports for work from 1/2 ounce to 8 ounces or for work from 8 ounces to 10 pounds are furnished.

The HS balancers are designed for fast setup over a wide work range. Special tooling for any job is simple and inexpensive. This includes such optional equipment as: special work-support fixtures for air- or electrically self-driven parts; work-support fixtures designed to permit balancing parts on their own bearings; a photocell unit that can replace the standard strobe lamp and which is used to energize a separate angle meter, or as an addition to the strobe lamp to operate an expanded scale tachometer for accurate speed indications on air- or electrically self-driven parts; and an automatic speed-control package for use in balancing air-driven parts.

Since the balancers are bench type machines they require no special mountings. Accuracy is not affected by extraneous vibrations or electromagnetic disturbances, including those set up by electrically self-driven assemblies. Regardless of work-piece weight or kind of drive, unbalance can be measured and located to full machine accuracy (0.000002-inch bearing displacement) in two transverse planes, as little as 1/4 inch apart, with unbalance indications in one plane completely unaffected by unbalance in the other.

Circle Item 570 on postcard, page 193

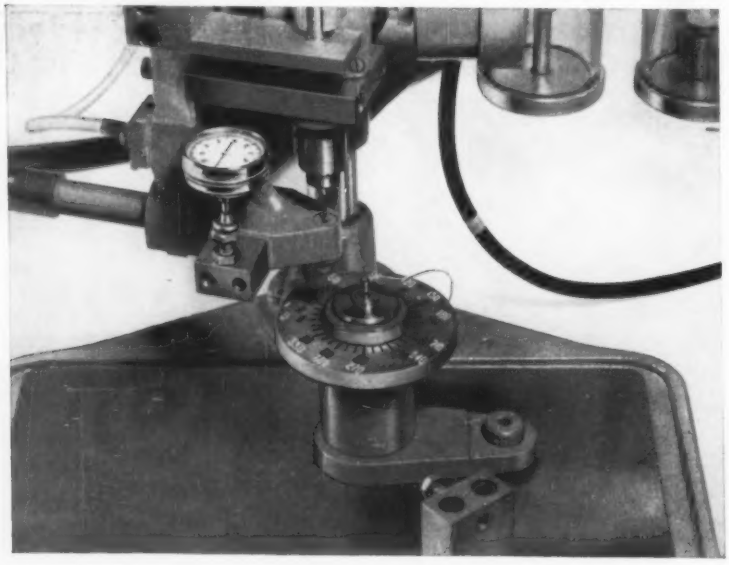


Fig. 3. Close-up of balancing drill unit shown at left in Fig. 1

"Spiralap" Machine for Mechanizing Hand-Lapping

A line of "Spiralap" flat-lapping machines is being offered by the Micromatic Hone Corporation, Detroit, Mich. These machines have been developed to eliminate the manual work characteristic of hand-lapping while providing extreme precision on flat work surfaces. It is claimed that any mechanic can productively generate lapping accuracy within one light band (0.0000116 inch) on this equipment.

"Spiralap" machine made by the Micromatic Hone Corporation

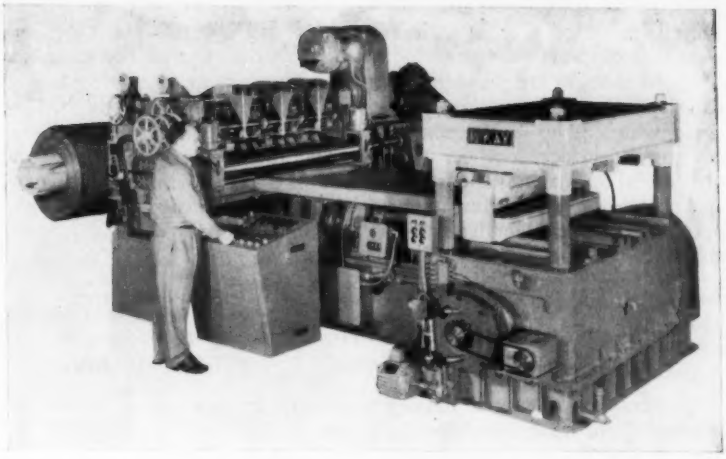
Quality control is maintained through the ability of the "Spiralap" to re-lap its own plates. In reconditioning the plates, it mechanizes the well-known hand-lapping method of having three laps of identical size lapped one to the other in sequence. In actual practice, only the plate on the machine is lapped with the successive plate when reconditioning is necessary.

The "Spiralap" design offers a patented combination of: a lapping plate with a spiral groove filled with abrasive compound; two (or more) adjustable work-locating arms to effect rotation of the work-piece by the lap; and two timers to control the work cycle and to total the use-time of the lapping plates between conditionings. As the plate rotates, a steady supply of compound moves between the work-piece and the plates, inducing a consistent or uniform abrading action.

Circle Item 571 on postcard, page 193

McKaymatic Line of Die Shears

The McKay Machine Co., Youngstown, Ohio, has recently announced the development of a line of automatic, electronic die shears designed for high production, simplicity of operation, and compactness. The shears in this McKaymatic line are electronically equipped to the point that they can be operated by manual push-buttons, IBM cards, or punched tape. They are built to handle coiled metal in any width and in most thicknesses. The demonstration line includes machines with capacities for cutting material that is 48 inches wide with a maximum thickness of 10 gage. Initial designs obtain production speeds of about 200 feet per minute when cutting lengths of 4 feet and over. Proportionally slower speeds are obtained when cutting shorter lengths. Any type coil holder can be applied to this line.



Die shear of new line announced by McKay Machine Co.

Circle Item 572 on postcard, page 193

Snyder Special Double-End Precision Boring Machine for Processing Transmission Cases

A special, double-end precision boring machine that performs eight variable machining operations on sixteen different transmission cases has been designed and built by the Snyder Corporation, Detroit, Mich. This electrically controlled, hydraulically operated unit bores two holes in each end of the transmission cases which range in length from 12 7/8 inches to 21 3/8 inches.

The variables that the machine is designed to accommodate, in addition to length, include variations in the sizes of all four holes; the depth of two holes; center distance of the holes; and variations in spindle speeds required for both cast-iron and aluminum cases. Transmission cases can be precision-bored on the machine at rates of from twenty-two to fifty-five pieces per hour, depending on the length of the part.

Two Snyder standard way type machining units, each having one flat and one V-way and a 19-inch maximum travel, are mounted on the welded-steel base of the machine. Each of the units has two spindles as well as a base which supports an individual 3-hp motor drive for each spindle. The spindles are driven by multiple V-

Snyder special double-end precision boring machine

belts. Between the two machining units is mounted a table with T-slots that supports the fixture.

Speed changes are provided for each spindle by a variable-speed drive which gives the necessary 300-sfpm (surface feet per minute) speed for machining cast iron and 1200-sfpm speed for aluminum. Interchangeable fixture details take care of part-clamping variables. A built-in chute directs chips and coolant into a coolant tank at the rear of the machine. The equipment is approximately 14 feet long and 6 feet high. Hydraulic power is provided by a separate power-pack unit. Once a set-up has been made for a particular part, push-buttons control the operating cycle.

Circle Item 573 on postcard, page 193

Pratt & Whitney Numeric-Keller Continuous, Tape-Controlled Three-Dimension Milling Machine

Continuous automatic milling of regular and irregular shapes in three dimensions to a high degree of accuracy, under the direction of tape-reading numerical control, is accomplished by the latest model Numeric-Keller machine introduced by the Pratt & Whitney Co., Inc., West Hartford, Conn.

In this unit, the horizontal and transverse movements of the table on which the work is mounted, as well as the vertical movement of the cutter spindle and the feed rates, are automatically controlled by punched tape. The operator is required only to push the button to start the tape, change the tooling as required, and set the spindle speeds. The machine is adapted for both short- and long-run production, particularly in tool-and-die plants.

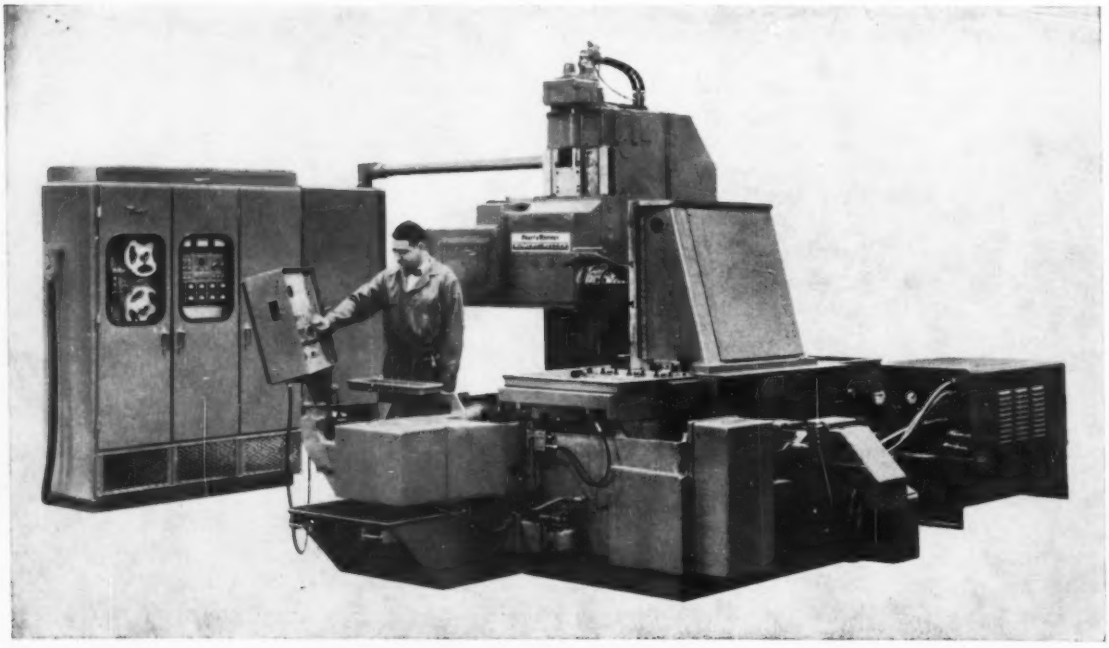
Since the numerical-control machine is run at maximum speeds and feeds during all phases of the cycle, machining costs are reduced considerably over conventional milling. The accuracy of the finished parts is also said to reduce the cost and extent of inspection. An excellent surface finish naturally results from the smooth, continuous path of the cutting tool. Both automatic roughing and finishing cycles can be coded into the tape to provide for final skin cuts. Symmetrical right- and left-hand parts may be cut with the same tape.

Versatility, rugged construction, and extremely accurate alignments are noteworthy features of the machine. It is equally capable of very heavy and very delicate work—under tape direction—with eighteen spindle speeds ranging from 40 to 3600 rpm. Table travel is 36 inches horizontally and 12 inches transversely. The vertical slide moves 22 inches. The table working surface measures 48 by 30 inches.

In contrast to tracer-controlled milling, the Numeric-Keller machine eliminates the need for templates, models, and complicated fixtures. In some instances the savings may be as much as 75 per cent.

The air-mist-lubricated spindle moves up and down on the vertical slide once the job is set up and the tape is started. Built-in control devices in the form of automatic error-detecting circuits and continuous digital feedback controls automatically shut down the machine if any malfunction is detected, or adjust motions if errors occur.

To prepare a tape for machine operation, a line drawing of the part is translated into a numerical drawing, which the process planner uses to set up a process sheet.



Numeric-Keller continuous, tape-controlled three-dimension milling machine

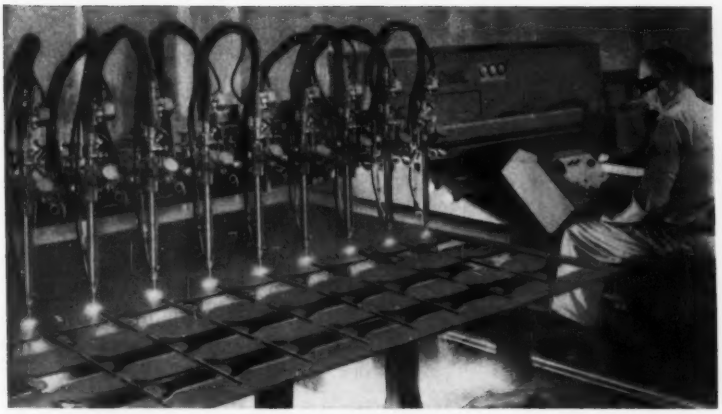


Fig. 1. Oxweld automated flame-cutting machine equipped with ten torches controlled by Linde "Photocell Tracer"

Setup point, table movements, tolerances, feed rates, tool sizes, circle radii, and any other required information are shown on this sheet. A paper tape is then punched from the process sheet data and verified. This is then fed to a general-purpose digital computer, which makes the required calculations and perforates the machine-control tape. A typewriter automatically records this data if desired.

Circle Item 574 on postcard, page 193

Linde Automated Oxweld Flame-Cutting Equipment

Intricate metal parts of any size can be easily reproduced in large quantities with a fully automated, unlimited-capacity, shape-cutting machine introduced by the Linde Co., Division of Union Carbide Corporation, New York City. Known as the Oxweld CM-60, the equipment (Fig. 1) is said to be the first American-made cutting machine to feature coordinate drive. It is powered by two electrically coordinated heavy-duty motors that provide ample power for flame-cutting intricate parts of any length, width, or thickness. Standard models can be equipped with ten torches to cut widths up to 10 feet. Larger models cut shapes of any width and can be equipped with additional torches. The thickness of metal that can be cut is limited only by the capacity of the torches used.

This cutting machine is equipped with a photoelectric tracing system that automatically compensates for kerf width. Parts can be reproduced from an exact-size drawing without the necessity of making allowance for kerf width on the drawing. Drawings of parts are made the exact size of the part desired. The kerf compensator dial is set for the plate thickness being cut. The machine then automatically compensates for kerf width so that reproduced parts are exactly the same size as the line drawing.

Simple pencil or ink sketches of intricate metal shapes and forms can be used to guide the flame cutter. The Linde "Photocell Tracer" accurately follows easily prepared pencil sketches made on ordinary paper, eliminating the need for expensive metal or plastic templates. Wear on templates and cover sheets is completely eliminated since neither the machine nor tracer ever comes in contact with the template or tracing surface. All cutting operations are accurately controlled by a single operator sitting at the control panel. Tracing, ignition, preheat, cutting oxygen, height adjustment of the torches, movement of the carriages, and positioning of the tracer can be handled from the control panel. Individual motors in each cutting-torch holder provide independent and accurate vertical control of each torch.

An outstanding feature of the Oxweld CM-60 is the automatic height-adjustment control on the motor of each cutting torch. The unit shown in Fig. 2 rides the plate in front of the torches and quickly senses the slightest deviation in the levelness of the plate surface. The motorized torch holders react instantly, lowering or raising the torches to compensate for any deviation in the work surface.

The complete cutting cycle is controlled through the operating-sequence dial on the control panel. Torch ignition, preheat, and cutting-oxygen gases are automatically controlled through solenoid valves. Flames can be cut off instantly, eliminating any bleed-down flow from the cutting-oxygen orifice which causes gouging after the cut is complete. When the operator wants to pierce the plate, a pilot valve at the control panel allows him to turn on the cutting oxygen slowly and evenly to prevent fouling of cutting nozzles.

Circular parts can be cut without the need of templates with a special circle cutting attachment.

Circle Item 575 on postcard, page 193

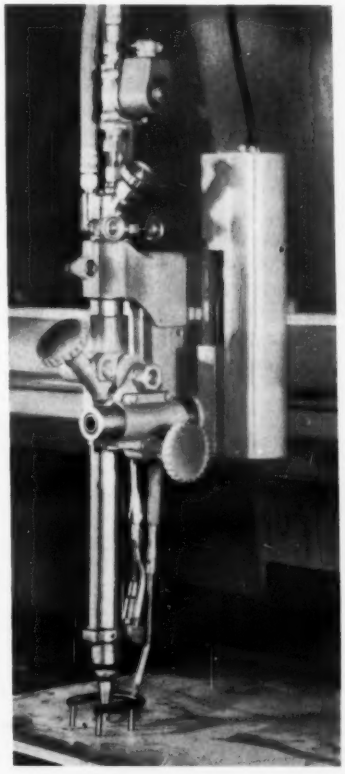
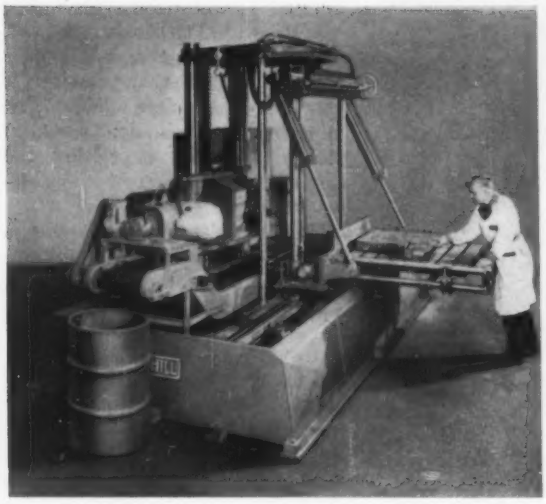


Fig. 2. Close-up of torch equipped with automatic height-adjustment control used on machine in Fig. 1



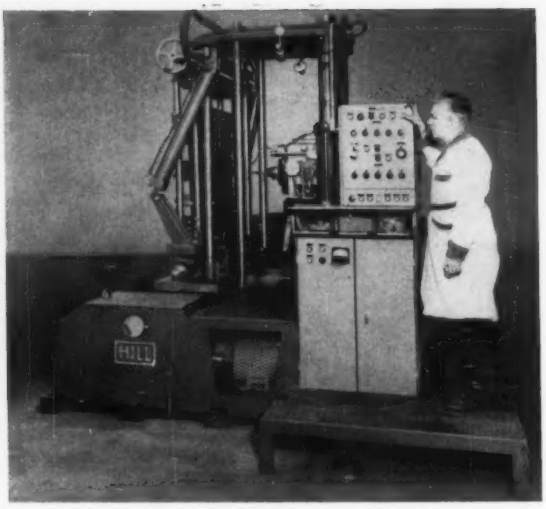


Fig. 1. (Left) Loading a stack of tube sheets on the tilted-down table of numerically controlled drilling and jig-boring machine built by Walter P. Hill, Inc. Fig. 2. (Right) View of General Electric Mark II numerical control panel mounted on the Hill machine shown at left

Numerically Controlled Machine Built for Drilling, Milling, or Jig-Boring Operations

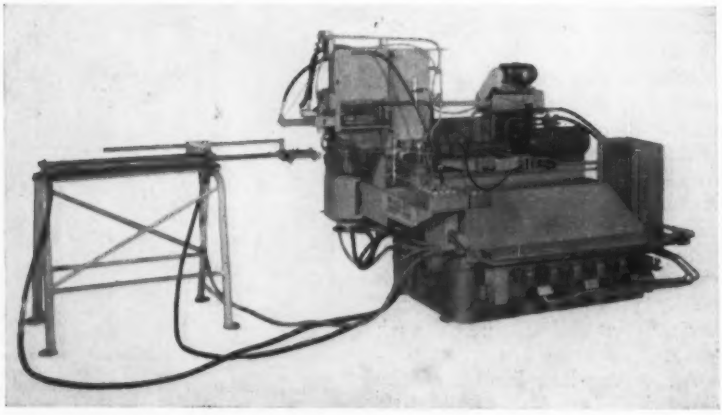
A low-cost, numerically controlled, high-speed, single-spindle precision machine that can perform a variety of drilling, milling, or jig-boring operations has been designed and built by Walter P. Hill, Inc., Detroit, Mich. This equipment is especially adapted for use in the manufacture of tube sheets by the heat-exchanger industry, jigs and fixtures by the tool-and-die industry, and for small-lot and job-lot production.

A rugged hydraulic-powered spindle enables the machine to drill or gun-drill holes 3/4 inch in diameter in steel at feeds up to 30 inches per minute. Work loading is facilitated by a hydraulic-powered tilting work-table which can be let down to the position shown in Fig. 1, for loading a stack of tube sheets. The machine is controlled by a General Electric Mark II universal numerical positioning control which can be seen in Fig. 2. Punched tape made from typewritten instructions is used to carry out a programmed spindle-location and operation sequence.

Circle Item 576 on postcard, page 193

Wallace Automated Tube Bender

The Wallace Supplies Mfg. Co., Chicago, Ill., has developed a completely automated bending machine adaptable to a variety of production tube-bending jobs. The button is pressed, and the bender feeds tubes into position, bends them, and removes the bent tubing without attendance other than to keep the inlet conveyor or hopper supplying tubes. Two tubes can be processed during each operating cycle of the machine. Simple tooling changes provide versatility in the type of bends: Flat-back "U's" can be produced at the rate of 1800 bends per hour, or conventional return bends at the rate of 980 bends per hour.



Automated tube bender developed by Wallace Supplies Mfg. Co.

From a hopper collector, a special finned elevator picks up programmed tube lengths and indexes them into a pair of vertically stacked loading trays. Sorting fingers fill both trays with tubes, and stop the elevator automatically, re-starting it when the supply of tubes drops to two in each tray.

From the loading trays sequence-controlled hydraulic cylinders select the tubes and re-index them into the bending dies. The clamping dies advance and secure the tubes in the forming dies. Mandrels are next automatically inserted into

the ends of the clamped tubes to support the tubes during bending. Bending dies are self-compensating and hydraulically actuated for uniform application of forming forces, and also for minimum maintenance and simplest control of degree of bend.

After bending, the clamps open and a stripper mechanism removes the two tubes from the bending die and drops them onto a conveyor. With the return of the bending arm one complete cycle is completed.

Features of this machine include: provision of an audible alarm that warns material handlers that thirty minutes or less remain before the tube supply will be exhausted; a speed and rotation control of the hydraulic bending cycle to give different bends or speeds; and a pressure system of internal lubrication including internal lubrication of the tubes and mandrels.

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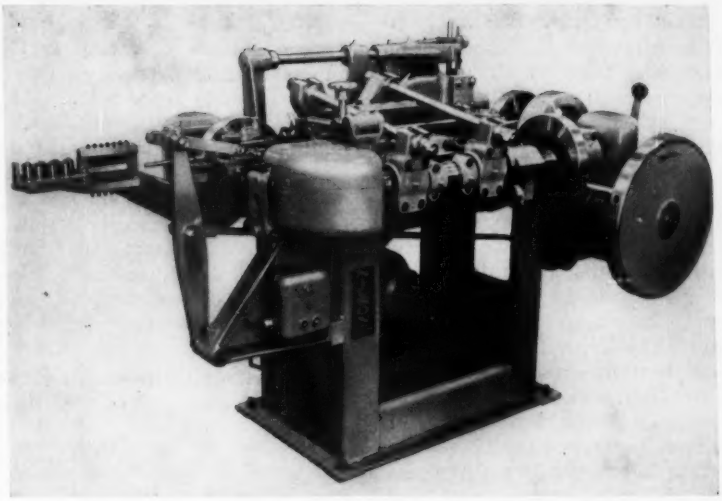


Combination press and four-slide machine built by A. H. Nilson Machine Co.

Nilson Combination Press and Four-Slide Machine

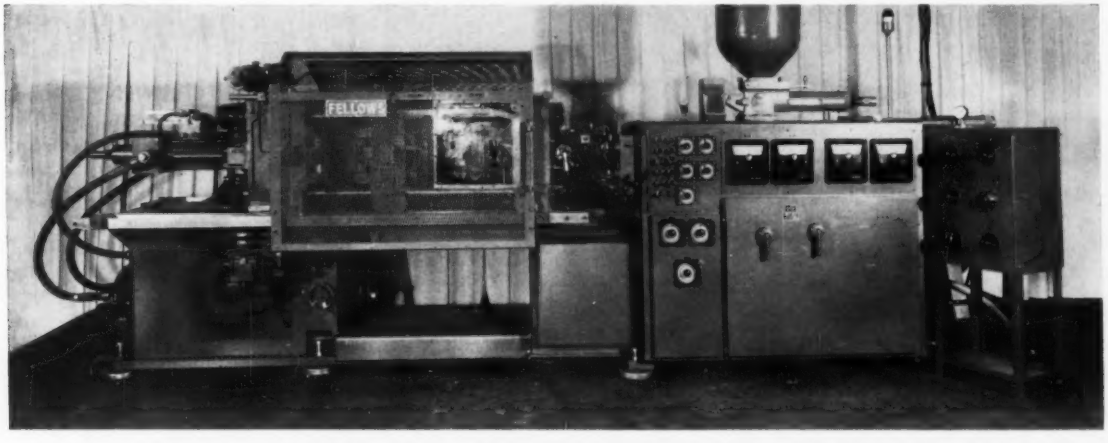
The A. H. Nilson Machine Co., Shelton, Conn., has announced a stronger, more compact No. S-1-F combination press and four-slide forming machine. The improved unit is now mounted on a welded-steel pedestal base for maximum strength and rigidity. To reduce the required floor space to a minimum the variable-speed motor drive is positioned directly in back of the machine, instead of on the end. The floor space of only 53 by 57 inches represents a reduction of more than 1000 square inches as compared to the previous model. Other features include double gibs and a Twin Disc clutch.

The S-1-F machine, designed primarily to stamp and form ribbon metal in one operation, will also form wire with a maximum feed length of 8 inches. It can handle wire up to 3/32 inch in diameter and ribbon metal up to 1 1/4 inches wide. The built-in press section has a 3/4-inch stroke and a maximum pressure capacity of 8 tons. A 2-hp motor drive permits speed ranges from 57 to 200 strokes per minute.

Circle Item 578 on postcard, page 193

Fellows Injection Molding Machine

A Fellows No. 6-10-225 injection molding machine designed to mold a wide variety of plastic products in the 6- to 10-ounce size range is announced by the Fellows Gear Shaper Co., Springfield, Vt. The 10-ounce shots require the use of the "Pre-pac" or stuffing device which is standard equipment on this unit. With the standard 20-hp motor and 45-gallon-per-minute pump, the machine dry-cycles from 825 to 925 times per hour with a shortened press stroke. The injection rate is 8.75 cubic inches per second.



Injection type plastics molding machine brought out by the Fellows Gear Shaper Co.

This equipment handles mold bases up to 15 by 25 inches with a maximum draw or stroke of 14 inches, which is adjustable down to 8 inches. It is equally capable of producing either the deep-draw, thin-wall parts such as pint, quart, or half-gallon containers on a less than 10-second cycle, or the heavier sections encountered in industrial parts where the weight may go up to 10 ounces and the cycle length to 60 seconds or more. The Taper-Tite torpedo-design heating cylinder plasticizes up to 100 pounds of Polystyrene per hour at 420 degrees, plus or minus 10 degrees, based on the use of a string thermocouple to measure temperature of material as it comes from the nozzle. A ball-joint adapter, into which the nozzle is screwed, is a new feature in the cylinder design and affords the means for ready alignment of the sprue bushing and heating cylinder. Cylinder-heat control is through two proportioning Amplitrol temperature controllers which are vibration-proof.

The toggle type press is hydraulically operated and has a mold-locking pressure of 225 tons. It features a supported, movable die-plate with tie-rods pre-loaded at the front end and easily pullable when necessary. Included in this unit is a center knockout plate with up to 4 inches of travel, and Trabon automatic lubrication at all vital bearing points.

As a safety precaution, the standard machine control circuit requires the operator to open and close the door before the next cycle will start but the unit can be made fully automatic by adding the optional automatic molding kit. This kit consists of a re-cycle timer, air blast, counter, dual injection control, and safety device.

An oversize 12- to 20-ounce heating cylinder can be mounted readily on the machine for customers who need this additional capacity. Also as optional equipment, a 30-hp motor with a 56-gallon pump can be suplied which increases the injection rate to 10.7 cubic inches per second and the cycles to 975 to 1100 per hour.

Circle Item 579 on postcard, page 193

Red Ring Equipment Developed for Honing Teeth in Gears up to 200 Inches in Diameter

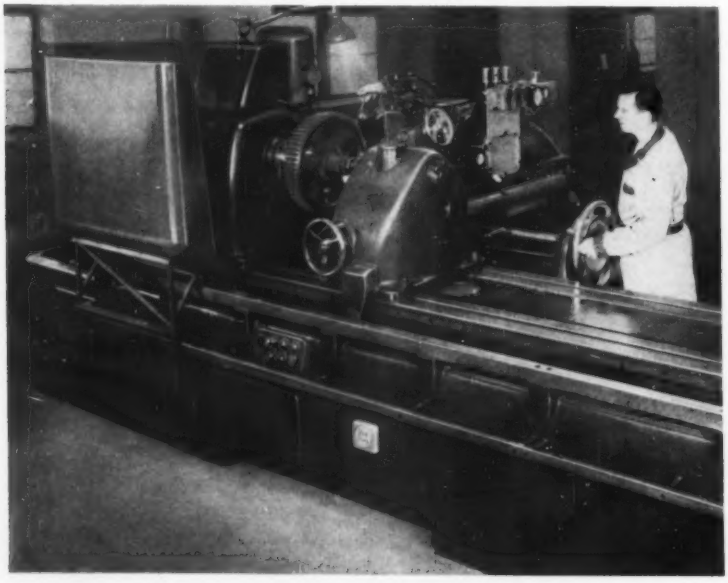
A method that will enable manufacturers of spur and helical gears in the 12- to 200-inch diameter range to economically apply the gear-tooth honing process has been developed by National Broach & Machine Co., Detroit, Mich. Applied to a prototype model as shown in the illustration, the method makes use of separate tool heads and feeding mechanisms that enable one large rotary machine to perform both the gear-tooth shaving and the gear-tooth honing operations.

Separate heads are employed, since the method used for bringing the tool into contact with the work is basically much different for gear-tooth honing than it is for rotary gear shaving. The Red Ring honing method makes use of a patented tilting table. For large gears, this arrangement takes the form of a hinged tool-head that enables controlled light pressure to be applied between the honing tool and the work gear. Rotary gear shaving, being a free-cutting, stock-removal process, requires no such special tool mountings or control of work pressure. Other essential differences between shaving and honing lie in the speeds of tool rotation and cutting-fluid requirements. But by developing one machine to perform both of these types of tooth-finishing operations, significant economies in capital-equipment outlay are achieved.

The advantages of the Red Ring gear-tooth honing process in improving the silent running qualities of hardened gears by removing nicks and burrs, making small tooth-form corrections, and improving tooth surface finish in gears under 12 inches in diameter can now be obtained in the production of gears up to 200 inches in diameter.

In operation, the abrasive honing tool is meshed with the work in cross-axes relationship. The work gear is turned by a motor, and drives the tool while it is traversed back and forth across the face of the gear. The Red Ring honing process for large gears can be applied immediately following the shaving process to improve surface finish on gears that are processed in the semi-hardened state; or used immediately following the hardening process where gears are hardened to levels above cutting-tool, metal-removal ranges.

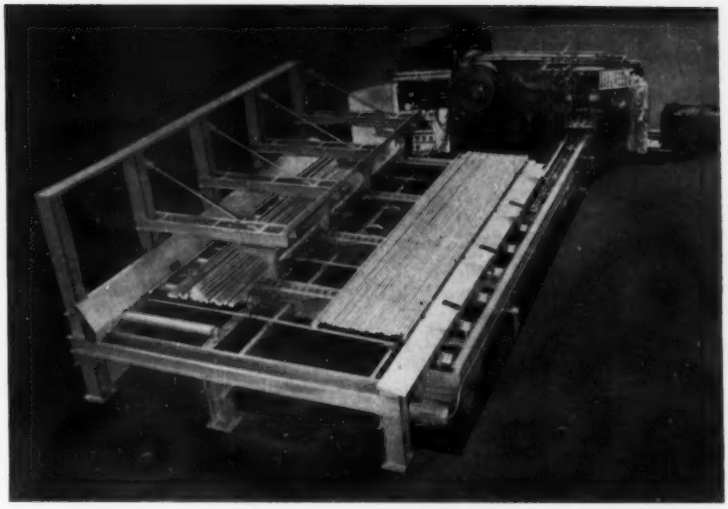
Circle Item 580 on postcard, page 193



Prototype Red Ring shaving machine showing the tilting gear-tooth honing head performing a finishing operation on a large spur gear

Hill Acme Bar Shear

The Hill Acme Co., Cleveland, Ohio, has developed a type of bar shear which has been built in various sizes ranging from low-production, hand-fed machines to high-speed, fully automatic models operated by one man. The latest addition to this line, shown in the illustration, is a high-production, automatic bar-shearing machine. This equipment was developed to shear high-tensile strength bars 2 inches in diameter, two pieces at a time, to lengths ranging from 12 to 50 inches, with provision for automatic disposal of the scrap ends of bars.



High-speed, automatic bar-shearing machine developed by Hill Acme Co.

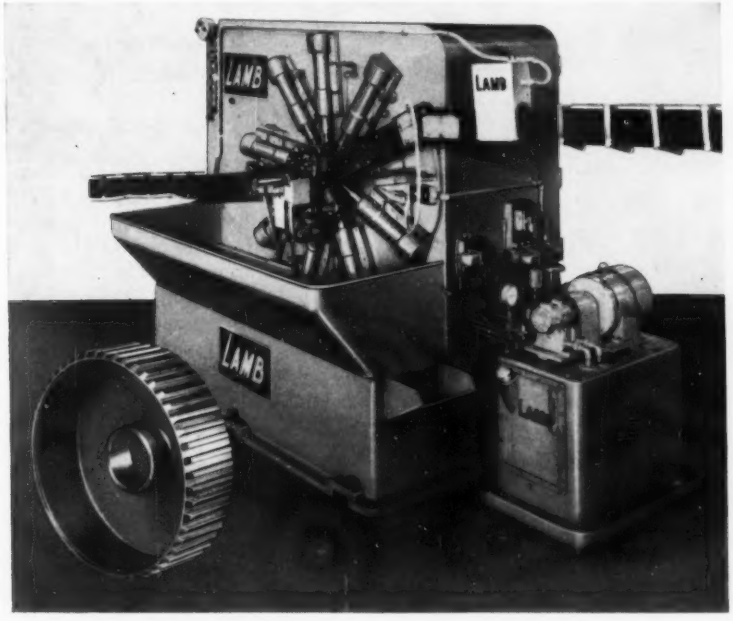
Open bundles of bar steel to be cut are loaded on a yard conveyor and transferred automatically onto a cross-chain magazine. An adjustable scraper arrangement is used to break down the bundles to a single bar depth for discharge onto a double-grooved feed conveyor. Two bars are fed off the conveyor to a predetermined, retractable length gage which automatically energizes the clutch on the shear that makes one cut. As the bars are cut, two more bars are automatically discharged to the feed conveyor producing fifty pieces of cut material per minute. With the use of an automatic hold-down, bar kick is eliminated. High-quality cuts, with a minimum of deformation, are possible with the unique outboard support.

As the pieces are cut, horizontal chains carry them to drop-off chutes for deposit into reciprocating tote boxes and automatically stack the cut pieces.

Circle Item 581 on postcard, page 193

Automatic Machine with Nine Radially Located Spindles

F. Jos. Lamb Co., Detroit, Mich., announces a machine designed to drill, simultaneously, nine oil holes, 0.090 inch in diameter, equally spaced around the periphery of automatic transmission-clutch hubs. This equipment has a production rate of 480 parts per hour, is completely automatic in operation, and does not require the attention of an operator. Parts are gravity-fed to the machine-loading mechanism by Lamb "FabriFlex" chute equipment. A hydraulic cylinder strips each part out of the loading mechanism and moves it forward into the drilling position.



Nine-spindle machine built by F. Jos. Lamb Co. for drilling clutch hubs

Two of the gear teeth straddle a single guide rail which provides radial positioning for hole locations. The hydraulic cylinder also acts as a clamp during the drilling operation. A disappearing locating pin in the center diameter of the part provides a bearing surface to take the machining thrust.

Nine spindles are mounted radially on the vertical face of the machine as shown in the illustration. They are electrically driven and hydraulically fed. Feed stroke and return, for all nine spindles, is controlled by a single circular cam. Upon completion of the drilling cycle the load-clamping cylinder and locating pin retract, dropping the part into an unload

chute for movement to the proper positions for subsequent operations. Provision is made to retract the spindles an additional 4 inches to facilitate tool changing.

The drilling operation can be performed with or without a coolant. A removable tub and screened basket are provided for fast chip removal. An electrical push-button panel permits manual machine cycling. Hydraulic components are manifold-mounted to simplify piping and facilitate servicing, and all hydraulic, electric, and pneumatic components conform with JIC standards.

Circle Item 582 on postcard, page 193

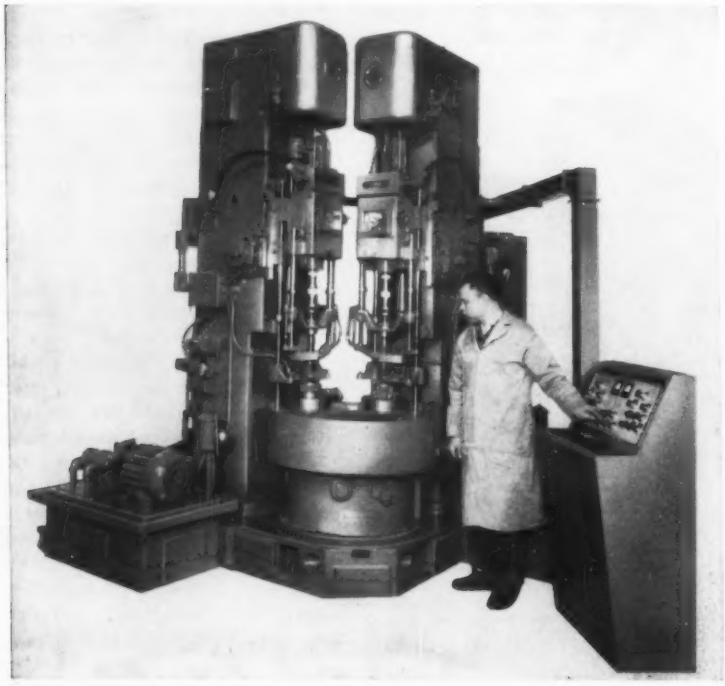
Special Two-Station Honing Machine

Motor rotors are honed at the rate of 200 parts per hour on a special two-station production type unit built by the Barnes Drill Co., Rockford, Ill. The rotors honed on this machine are constructed of laminated steel and vary from 3 to 4 inches in length in different lots. The required bore size in these work-pieces remains constant at 0.8750 to 0.8755 inch with a surface finish of 25 microinches. BarnesdriL tooling designed for this critical job is holding bore diameters to size well within 0.0002 inch while removing 0.003 inch of stock.

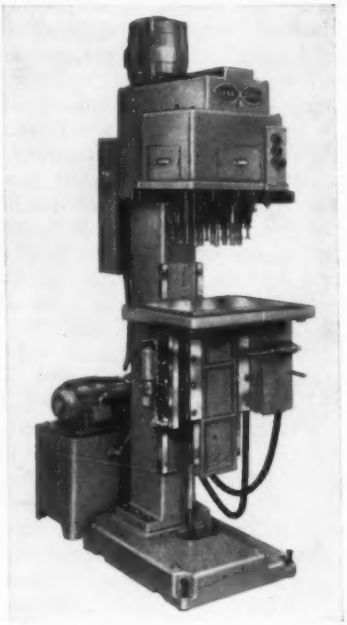
Two complete, standard BarnesdriL Model No. 223 vertical type honing machines are mounted on a common base with a two-station, 180-degree index-table equipped with four fixtures. The two honing units operate independently or simultaneously as the job requires. Changing the stroke on one unit to accommodate parts of a different length does not interfere with the operation of the second unit. This flexibility is needed when production schedules require specific quantities of different parts at the same time.

Both units are equipped with electronic hone expansion and Plugmatic automatic bore-to-bore sizing units. The hydraulically operated, rotary index type table rotates 180 degrees in each direction against positive stops to assure accurate positioning of the parts at each honing station. All machine functions are electrically interlocked for complete safety in operation.

Circle Item 583 on postcard, page 193



BarnesdriL two-station honing machine



"Deka-Drill" for automatic cycling built by Precision Tool Mfg. Co.

Multiple-Spindle Drilling and Tapping Machine

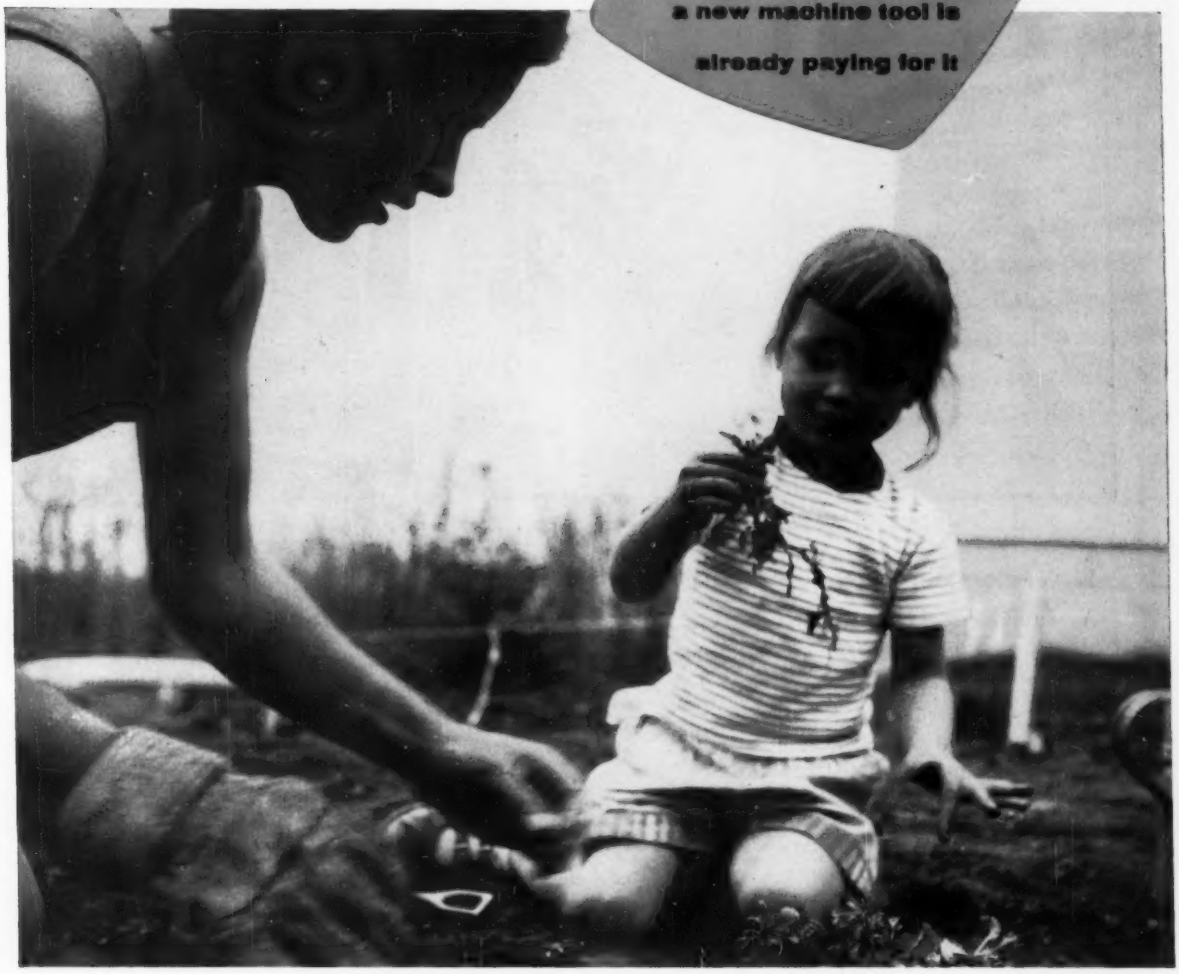
A low-cost "Deka-Drill" designed to drill or tap up to twelve holes simultaneously has been announced by the Precision Tool Mfg. Co., Cicero, Ill. This multiple-spindle drilling and tapping machine is available in the manual Model M-712 and the hydraulic Model H-712 illustrated. The two Deka-Drill models are essentially alike, except that the M-712 is manually operated by hand or foot-pedal while the H-712 is a fully automatic-cycle machine tool. The machine has a 2-hp, three-phase motor which has a speed of 1200 rpm. With a speed of 60 surface feet per minute and a feed of 1 1/2 inches per minute, the drilling capacity is as follows: six 3/8-, ten 5/16-, or fourteen 1/4-inch holes. At 75 per cent thread, 20 inches per minute feed, the machine has a capacity for tapping five 5/16-18; eight 1/4-20; twelve 10-32; and fourteen 8-32 threads.

Circle Item 584 on postcard, page 193

(This section continued on page 184)

JONES & LAMSON MACHINE COMPANY

the man who needs a new machine tool is already paying for it



Spring planting...1949

Just ten short years ago, but a lot of changes have taken place.

Except for Mother, who is every bit as attractive, nothing has remained the same. The garden is now long-established and flourishing, and Daughter is entering college in the fall.

In Dad's shop, things are quite different, too. Labor rates, prices of raw materials and overhead have kept climbing constantly.

Those once-new machines are still running O.K., and seem to have plenty of usefulness left in them. The big hitch, though, is that their performance standards were based on the costs of *ten years ago*. With today's increased costs, the *profitability* of these machines is in serious doubt.

The cost analyses Dad is now completing show very clearly that successful production under *today's* conditions requires *modern* equipment. He used J & L's new "Avoidable Costs" Replacement Formula. It's simple, clear cut and realistic, and avoids the fallacies found in other replacement formulas.

Write for your copy.

Jones & Lamson Machine Company, 512 Clinton Street, Springfield, Vermont.

Turret Lathes • Automatic Lathes • Tape Controlled Machines • Thread & Form Grinders • Optical Comparators • Thread Tools

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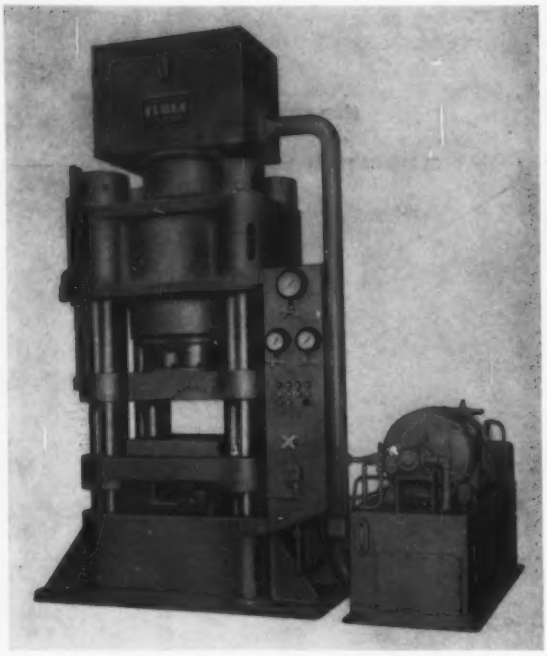


Elmes custom-designed hydraulic coining press

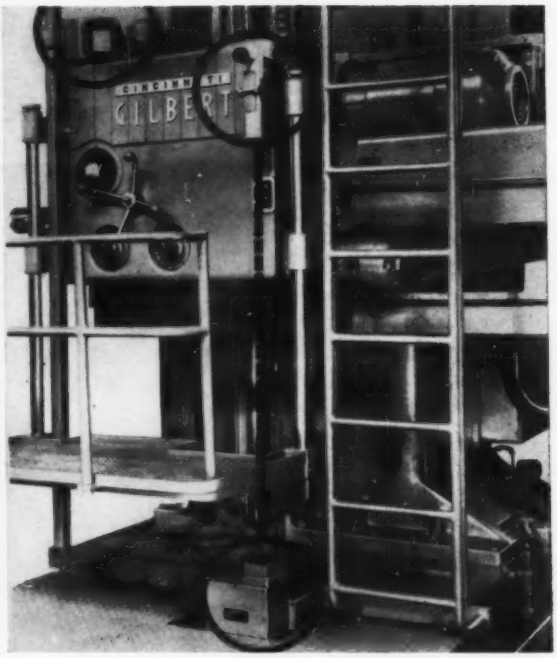


Fig. 1. Boring mill equipped with optical measuring system

Hydraulic Coining Press

A custom-designed, 1000-ton hydraulic coining press has been brought out by American Steel Foundries, Elmes Engineering Division, Cincinnati, Ohio. This press is intended primarily for single-action coining of sintered metallic compacts which require extremely high unit pressures. Because each compact to be processed is of a delicate or fragile design with respect to size and shape, it was necessary to maintain very close machining tolerances in building the press. It was also necessary to provide the press with highly sensitive controls.

An intermediate, hydraulically actuated moving platen (dieholder) is incorporated in the press to provide for "straight-through" ejection of the coined compact. This intermediate member is supported above a pneumatically operated anvil slide which moves horizontally. During application of pressure to the compact, the anvil is aligned beneath the intermediate platen where it serves as a non-yielding base for the die or mold. During ejection, the intermediate unit is automatically raised sufficiently to "clear" the anvil and die. This permits the coined piece to be pushed through the bottom of the die onto a shuttle. The shuttle, during subsequent cycles, carries each coined compact to the front of the press for removal.

The intermediate platen can be adapted, with a minimum of time, to serve as a second, or floating, platen, as is normally required for double-action pressing of powdered metals. The equipment, as described, has been developed for either fully automatic or semi-automatic cycling.

Circle Item 585 on postcard, page 193

Cincinnati Gilbert Optical Measuring System

An optical measuring system for horizontal boring, milling, and drilling machines has been announced by the Cincinnati Gilbert Machine Tool Co., Cincinnati, Ohio. The Gilbert Tele-Vernier of this system is an optical projection device designed to increase the accuracy and speed of reading vernier scales for vertical and horizontal movements of a boring mill. Fig. 1 shows a Cincinnati Gilbert boring mill equipped with

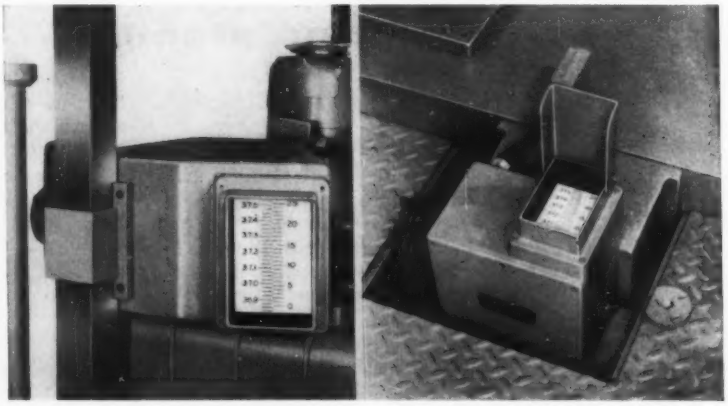


Fig. 2. Close-up views of ground-glass screens with etched vernier scales on which images of stainless-steel measuring scales are projected

JONES & LAMSON FORM GRINDERS

the man who needs a new machine tool is already paying for it

Rapid, precise form grinding with PFC keeps outboard motor production at full throttle

The new V-type construction of Evinrude's smooth-running outboard motors is giving power-packed pleasure to boat owners.

In the initial stages of production, however, this new motor posed new, tough manufacturing problems for Evinrude production men.

For example: the prime moving parts of this balanced outboard design are short, rigid crankshafts. The pins of these crankshafts had to be ground to .0005″ tolerances on diameter, and to .0001″ taper on the length of the pin. Required production: 110 pieces per hour.

J & L Model E Form Grinders proved to be a key factor in meeting these rigid production requirements while maintaining highest quality standards.

In another Model E application on the same motor, two grooves are formed from the solid in stainless steel propeller shafts at a rate of 146 parts per hour (illustrated). There is *no time out for wheel dressing*, because this machine is equipped with PFC (Perpetual Form Control).

This sort of grinding efficiency can keep *your* production roaring at full throttle, too. Write for detailed information. Jones & Lamson Machine Company, 512 Clinton Street, Springfield, Vermont.

Turret Lathes • Automatic Lathes • Tape Controlled Machines • Thread & Form Grinders • Optical Comparators • Thread Tools

For more data, circle this page number on inquiry card

the measuring system. Fig. 2 is a close-up of the ground-glass screens on which measurements are read. Two of these screens are shown inclosed by heavy black circles in Fig. 1.

The image of the long stainless-steel scale, graduated to 1/40 inch, is projected on the 3- by 5-inch ground-glass screen. The vernier scale is etched on the screen and has twenty-five graduations. About 0.6 inch of the scale is projected on the screen.

The Tele-Verniers are controlled from the pendent station on Cincinnati Gilbert boring mills. Each control includes a push-button for illuminating the screen, as well as two buttons which adjust the vernier for the starting position, so that the operator can start at a convenient reading.

Circle Item 586 on postcard, page 193

Burgmaster Turret Drilling Machine Equipped with Pressure-Foot Guide

To provide rigid support for small drills used on Burgmaster turret drilling machines in order to obtain greater accuracy, reduce drill breakage, and insure longer tool life, the Burg Tool Mfg. Co., Gardena, Calif., has introduced a turret-carried pressure-foot guide. Many advantages in small-hole drilling are claimed for this equipment. The work is held down with spring tension, which eliminates vibration and chatter, one of the chief causes for drill breakage. Drills are gripped closer to the cutting end, thus reducing torsional twist and chattering so that tool life is lengthened. The drill bushing is built in and the drill does not have to constantly reenter the bushing.

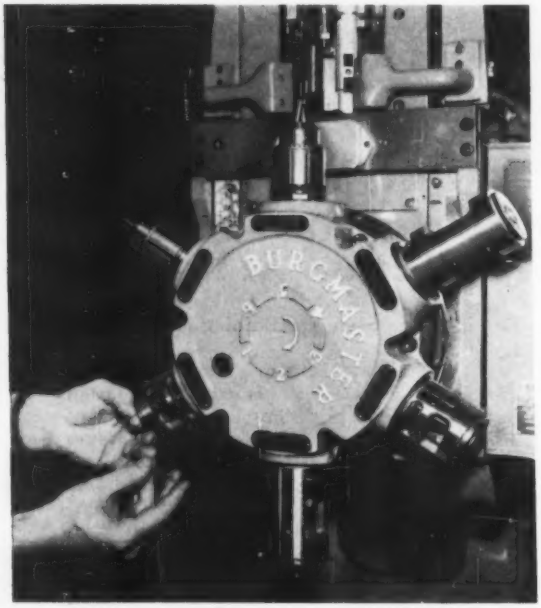
Perfect alignment is also assured and any chance for drill bending is eliminated. Drill wear is reduced, which results in more accurately sized holes. Closer tolerances are held on the spacings between holes because the drills cannot be deflected when starting into the work. Total overhang from the spindle bearings is held to a minimum. The use of the pressure-foot guide eliminates the need for center drilling to hold tolerances, thus saving valuable machine time. Special gearing provides a top speed of 4000 rpm for drills held in the turret shown in the illustration.

The tools illustrated are mounted on a Burgmaster 2 BHT automatic tape-controlled turret drill used for drilling printed circuit boards. The pressure-foot guides assist materially in holding the ±0.002-inch or better locations with drills 0.029 and 0.052 inch in diameter. No center drills are used or required. Drills from No. 80 to 1/4 inch can be used effectively.

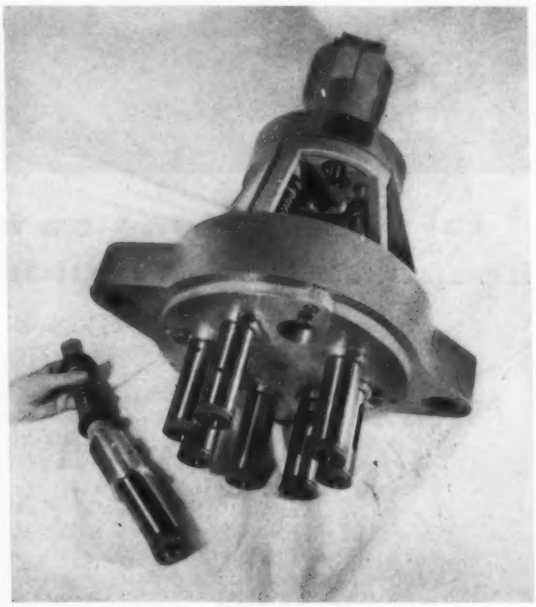
Circle Item 587 on postcard, page 193

Thriftmaster Universal-Joint Drill Head

Fast, easy removal of spindles, bearings, and related parts is a feature of the cartridge type spindle-plate construction now available with Thriftmaster universal-joint type adjustable drill heads. This construction is now offered on the full line of universal-joint drill heads manufactured by Thriftmaster Products Corporation, Lancaster, Pa. The cartridge plate provides the spindle rigidity and accuracy usually found only in fixed-center heads, while retaining the adjustable feature required for handling various hole patterns. Removal of one lock screw permits the cartridge containing spindle, bearings, and related parts to be removed from the plate as a unit.



Burgmaster turret drilling machine with turret-carried guide bushings for drills and holding work flat



Thriftmaster universal-joint drill head of cartridge type spindle construction

JONES & LAMSON 180° TRACER

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Does more work in one chucking... reduces off-machine time

The new J & L Two-Dimensional Turret Lathe Tracer cuts costs to the bone, by reducing handling time and all the wasted effort that goes along with it.

In addition to all of the versatility and accuracy of the standard J & L turret lathe, this equipment offers four completely automatic tracing cycles, each of which gives tool travel control of more than 180°.

For instance, you can rough out a part with conventional turret lathe tooling, then trace through 180° of turning or boring, and 180° of facing — *all in one chucking.*

A single flat template can 1. Combine all contours for boring, turning and facing. 2. Accommodate the transition between tracer turning and tracer facing. 3. Permit automatic relief and return of the respective tracing tools.

Tooling mounted at the rear and front of the cross slide not only allows for rough and finish tracing with the appropriate tool, but also offers the potential of multiple tooling tracing operations through more than 180° of contour. *This* is true machining flexibility.

Write for folder No. 5903.

Jones & Lamson Machine Company, 512 Clinton Street, Springfield, Vermont.

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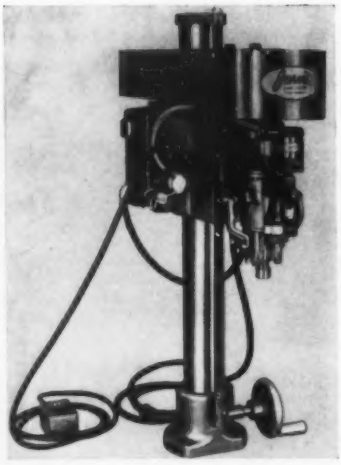
Cartridge type spindle-plate construction can be furnished with any of the Thriftmaster standard, semi-standard, or special universal-joint adjustable drill heads. Spindle assemblies with the usual Thriftmaster full ball-bearing construction are standard. For close-center applications, assemblies with bronze radial and ball-thrust bearings also are available and interchangeable with the ball-bearing assemblies. The illustration shows an eight-spindle head with the Thriftmaster spindle construction.

Circle Item 588 on postcard, page 193

Adjustable-Pitch Lead-Screw Tapper

The Jarvis Corporation, Middletown, Conn., has announced an automatic, adjustable-pitch lead-screw tapper, adaptable to any drill-press table. The unit is furnished in five standard models and has four speed-change pulleys that provide speeds of 575, 958, 1437, and 2415 rpm. The five models cover a tapping range from 24 to 80 pitch, No. 0 to No. 12 size threads, up to coarser 11 to 32 pitch, No. 10 to 5/8-inch threads. The tapping cycle is operated automatically through air and electrical controls and can be interconnected with the controls of an indexing table, if desired.

Tap depth is electrically controlled and can be set to any depth within the stroke of the lead-screw unit, which features rapid conversion from one pitch to another. Optional equipment is as follows: cycling button or foot switch; standard hand-operated lead-screw units, where complete automation is not desired; and multiple-spindle heads for multiple tapping operations on SP models.



Jarvis adjustable-pitch lead-screw tapper

Circle Item 589 on postcard, page 193

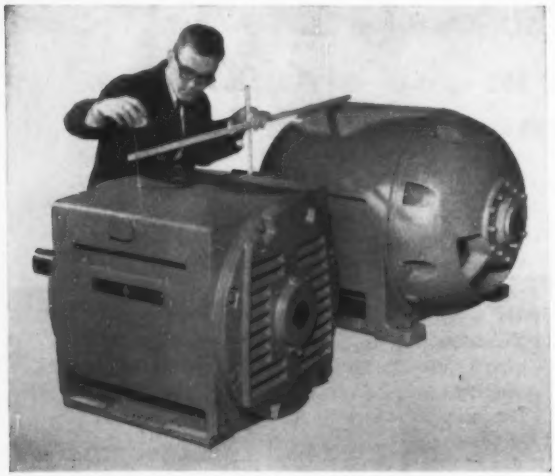
General Electric Motors with New Insulation

The General Electric Co., Schenectady, N. Y., has recently completed the redesign of its entire line of alternating-current electric motors. New features of these random- and form-wound motors—ranging from 1 to 5000 hp—are expected to extend the range of applications for open motors and provide tailor-made units to meet the specific requirements of the metalworking, paper, petroleum, chemical, rubber, mining, and other industries.

The "Custom 8000" general line with ratings from 100 to 600 hp features an entirely new "square look," as shown in Figs. 1 and 2. This styling departure is designed to keep pace with modern trends, offer better enclosure facilities, and save considerable floor space. Among other improvements are: adaptability to specific industry needs, faster installation, and easier accessibility for maintenance. Lower noise levels and greater over-all ruggedness are also advantages.

A number of accessory kits, such as splashproof louvers or space heaters to protect a motor in damp atmospheres, are available for quick conversions in the field. The square configuration provides a significant reduction in the amount of space required for motors of a given horsepower. Equipped with flat end shields that make them significantly shorter than preceding models, these motors offer savings in mounting area which range from 22 to 45 per cent, depending on rating.

Installation is simplified by an enlarged conduit box, and by lift-



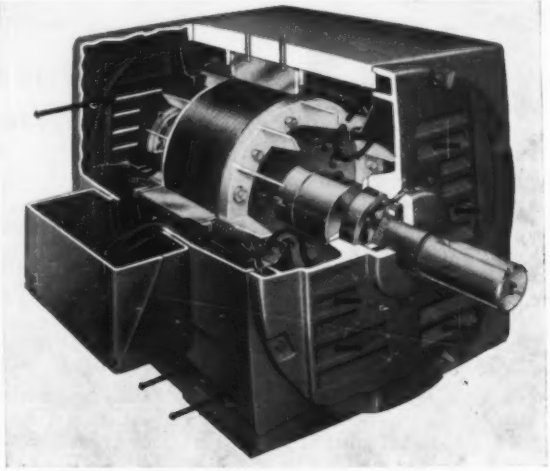
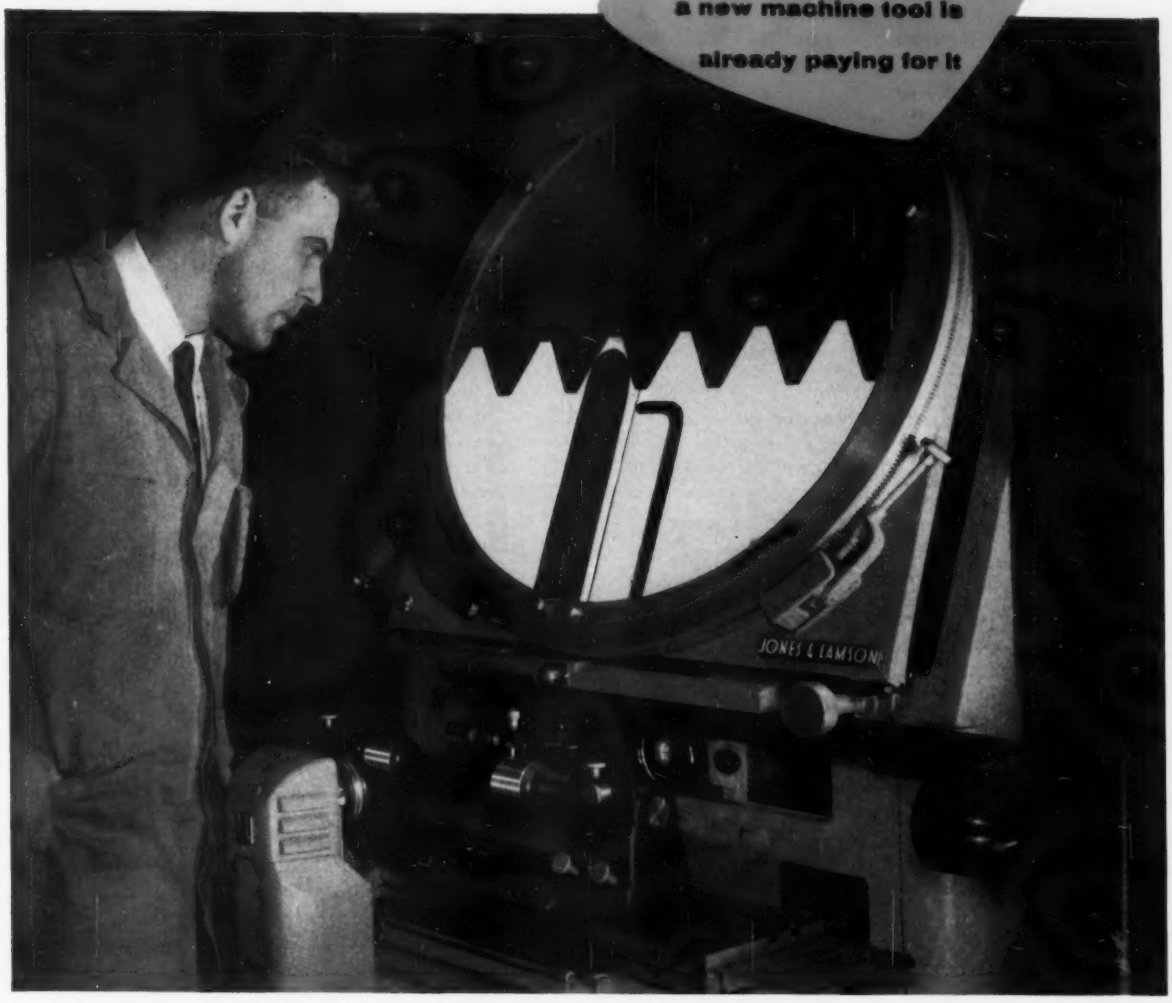


Fig. 1. (Left) Typical size reduction of General Electric's new line of 100- to 600-hp alternating-current motors is shown by this comparison of old and new 150-hp motors. Fig. 2. (Right) Cut-away-section view showing improved design features of General Electric motors

JONES & LAMSON OPTICAL COMPARATORS

the man who needs a new machine tool is already paying for it



Determines lead and spacing errors of less than .0001"

Lead amplification on J & L Comparators combines both optical and mechanical magnification in standard gaging set-up. It produces amplification of any lead error, in threads of all standard forms and pitches.

For example, a .0001" lead error is magnified to .050" or .100" on the screen. Measurements are made direct on the machine's micrometer, with ease and repeatability.

Other demanding applications, such as the extremely precise measurement of critical spacing between the valve ports and the piston lands of hydraulic valves, are also performed with this new amplifier.

The dependability of this attachment was demonstrated in a series of tests conducted on a special application by J & L engineers. Among other things, it was proved beyond doubt that a group of Jo blocks can be measured within .000025". Furthermore, these readings were easily repeated, even by different operators.

The speed, precision, flexibility and dependability of Jones & Lamson Comparators might well make a big difference in *your* operations. Write for Catalog 5700, Jones & Lamson Machine Company, 512 Clinton Street, Springfield, Vermont.

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ing lugs integrally cast into the motor frame. Nameplates are larger and reverse-etched for easier maintenance.

Pre-wound cores permit considerable improvement of the varnish impregnation, considerably lengthening the insulation life. Fig. 1 shows the flat, louvred end shields that combine with double-end ventilation to offer up to 75 per cent more air flow, and an enlarged conduit box for easier maintenance. A new anti-friction bearing design incorporates a special slinger that prevents grease loss and improves purging of old grease during relubrication.

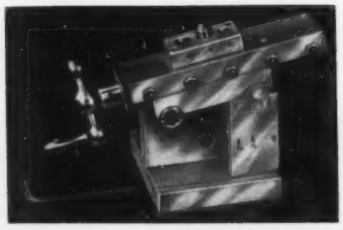
Several insulation systems are available with the motors. Among these are "Polyex" (registered trademark of General Electric Co.) insulation for normal Class A duty, and the "Polyseal" (trademark of General Electric Co.) Class B system of supported silicone-rubber insulation. Using the latter insulation, open motors may now be considered for some severe applications previously limited to totally enclosed motors.

Circle Item 590 on postcard, page 193

Matco Sine Dresser for Grinding Wheels

The Matco Division, Manting Tool & Die Corporation, Morley, Mich., has announced a Matco sine dresser designed for dressing wheels to practically any desired angle within accuracy limits of 0.0003 inch. This device is made for use with standard gage-blocks and sine table. Its diamond-holder block has a travel of 2 inches and is moved across the grinding wheel by a smooth screw feed actuated by a hand knob. Chatter is said to be eliminated. Adjustments beyond 45 degrees up or down provide for dressing wheels to the desired angle.

A split type hinge roll can be locked positively at any angle. The diamond-holder block can be mounted in two positions and has three hole sizes to accommodate standard diamond mountings.



Sine dresser for grinding wheels announced by Matco Division, Manting Tool & Die Corporation

Ways and platen are hardened and ground and the entire unit has precision-machined surfaces. Overall height, without the diamond, is 4 7/8 inches. By removing the diamond holder, the dresser can be used as a checking fixture.

Circle Item 591 on postcard, page 193

"Boremation" Gun-Boring Machine

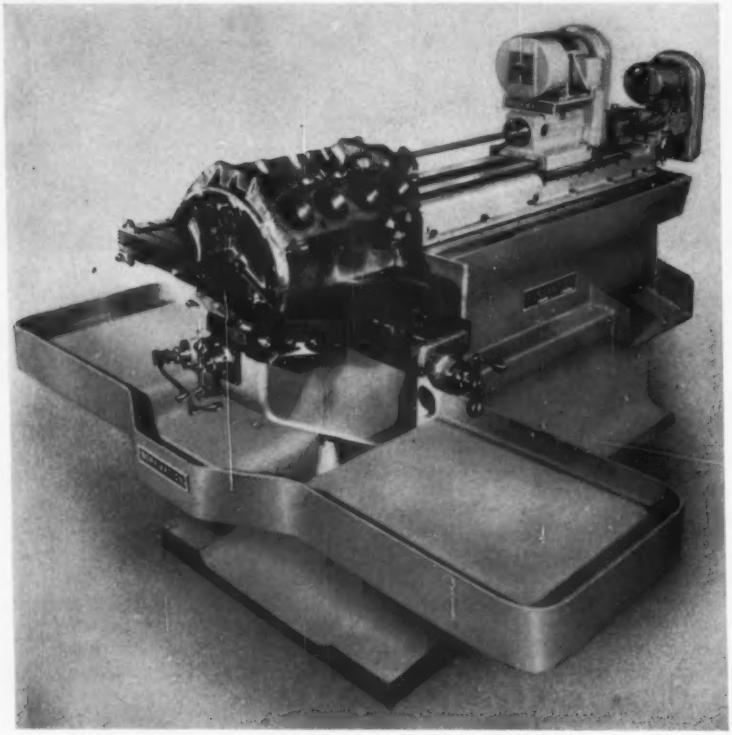
A "Boremation" gun-boring machine for drilling or boring a single finished hole or a group of holes in one pass with an automated control cycle is being introduced by the Drillmation Co., Inc., Center Line, Mich. This versatile unit is designed to drill deep or shallow precision holes to very close tolerances. The operator can position, space, and hold the work-piece for new drilling locations without removing the work-piece, thereby maintaining accurate hole relationship.

Once the work-piece is clamped and held securely to the traversing table, subsequent operations can be performed in the one hole location. If the work-piece has a series of holes to be drilled in different locations, however, each new hole position can be located (and the tolerance held) with the easily read hand dials. For extra-precision hole alignment, optics, measuring standards, or dial gages are also available.

The table of the machine has a longitudinal travel of 24 inches, a vertical travel of 16 inches, and a traverse of 12 inches. NMTB and JIC standards were used as guiding factors in designing this machine. A "Boremation" Model 2400 hydraulic way type power unit is shown in the gun-boring machine illustrated. Power units with 12- to 36-inch hydraulic or mechanical feeds are available.

Circle Item 592 on postcard, page 193

(This section continued on page 198)



"Boremation" gun-boring machine announced by Drillmation Co., Inc.

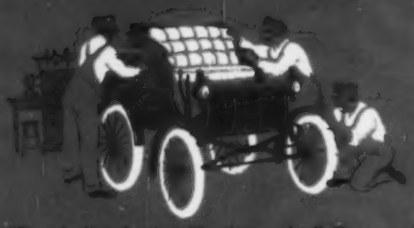
Hole in One.... Pass

When GREENFIELD submitted its bid for tools to thread the 38 rim holes in this forged steel atomic reactor vessel, other tap bidders were skeptical about tapping $4^{3}/_{4}$"-8 Class 3 threads, $9^{5}/_{16}$" to a bottom, in one pass, and still meet the required surface finish of 32 R.M.S. It looked like a job for sets of two or more taps.

But, a team of GREENFIELD tools .... Reamer, Tap and Plug Thread Gages .... handled the job at Babcock and Wilcox Company's works in Barberton, Ohio.

You may never have a threading job like this, but the same resources that engineered it are at your disposal when you buy any GREENFIELD Tap.

GREENFIELD TAP & DIE GREENFIELD, MASSACHUSETTS



"They don't make them like they used to". They sure don't, they were good — wonderful — for their day and some of them are still running — like they used to

but — With modern design and performance who would prefer an antique to this model? Yet many a shop is running today with yesterday's tooling.

Are you trying to turn out products to today's specifications with yesterday's tooling? Have you die heads 10-20-30 years old that are "as good as new"? Better let a Geometric man go over your threading operations and show you how New Geometrics can improve your threading and lower costs too!

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NEW CATALOGUES

REPLACEMENT FORMULA—Jones & Lamson Machine Co., Springfield, Vt. Catalogue describing a machine (or other capital-equipment) replacement formula based on a new concept. The formula analyzes a proposed replacement project in terms of the "avoidable costs" likely if the decision is postponed; in contrast to the traditional approach of analysis in terms of rate of return on investment, or the period of time it will take either to return the investment or obtain a favorable cash flow. Details of the formula and a work sheet are available on letterhead request, from Jones & Lamson Machine Co., 160 Clinton St., Springfield, Vt.

TOOL UTILIZATION—Kennametal Inc., Latrobe, Pa. Booklet entitled "There's Profit in Retiring a Tradition," featuring the theme of a campaign in modern tool utilization to spread a changing concept of machine tool practices of metal-cutting tool life, and of the expendability of throw-away carbide inserts. The campaign is intended to focus attention on the relative importance of tool costs and fixed machine expenses as they affect over-all machining costs per piece. **501**

NON - FERROUS SPECIFICATIONS—Centrifugally Cast Products Division, Shenango Furnace Co., Dover, Ohio. Bulletin No. 157, containing a detailed alloy chart showing comparative specifications, chemical analyses, and the minimum physical properties of the company's non-ferrous alloys. In addition, it shows and describes a broad range of component parts and assemblies regularly produced by the centrifugal method. **502**

MAGNIFIERS AND ALLIED PRODUCTS—Bausch & Lomb Optical Co., Rochester, N. Y. Catalogue I-52, providing a simplified, accurate means of selecting magnifiers and readers, including types adapted for use in shop, laboratory, and drafting room. It lists over sixty-five individual models (powers from 2X to 20X) including round and rectangular readers, folding pocket magnifiers, watchmaker's loupes, surface comparators, enlarging focusing magnifiers, etc. **503**

HYDRAULIC CYLINDER—Sheffer Corporation, Cincinnati, Ohio. Bulletin No. 159 featuring 1 1/8-inch bore hydraulic clamp type cylinder designed especially for rugged automation, tooling, and production-line applications. Known as the Sheffer CLH series cylinder, the unit is ultra compact, being only 1 5/8 inch square and very short in over-all length. **504**

RIVET STANDARDS—Tubular & Split Rivet Council, New York City. Industrial guide on "Dimensional Standards for Semi-Tubular Rivets," designed to facilitate the work of industrial rivet users. It contains standards data on all major classes of semi-tubular rivets. It also includes such information as body and head diameters, head thicknesses and radii, and hole diameter and depth figures. **505**

AUTOMATION—Michigan Special Machine Co., Warren, Mich. Catalogue outlining the company's services for automation equipment. Pictures and drawings of various models of equipment are shown, along with pictures and drawings of parts produced on their machines. Also shown are detailed drawings of various tools and components used in high-production metal cutting. **506**

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FITTINGS—Wallace Supplies Mfg. Co., Chicago, Ill. Booklet giving general information and prices on "Tapered Diamond" slip fittings. These fittings are made of extra strong "Hi-tensile" aluminum alloy of aircraft quality. A 12-page book giving engineering data on all these slip fittings is also available. **507**

TAPE-CONTROL POSITIONING—Jones & Lamson Machine Co., Springfield, Vt. Brochure (Form LO-5902) on J & L tape-controlled positioning, describing the advantages of this method as well as illustrating various applications. The booklet also tells that retrofitting (or "Do It Yourself") applications may be accomplished with packaged positioning units offered by J & L. **508**

METAL CLEANING—Oakite Products, Inc., New York City. Folder F 10596, presenting savings made possible by the cleaning of metals with Oakite "Room-Temp Cleaner." The booklet points out other advantages of the material: its long life in solution; its ability to retard rusting of steel between operations; and its safety on steel, aluminum, copper, brass, and zinc, and their alloys. **509**

MANIFOLDS—Air Reduction Sales Co., a division of Air Reduction Co., New York City. Catalogue (Form ADC 636E) describing the complete line of Airco manifolds for industrial gases. It contains specific information, with illustrations, on capacities, dimensions, and arrangement, along with general background material on the advantages of manifolding. **510**

GAGING PRODUCTS—DoALL Co., Des Plaines, Ill. Brochure presenting facts on black-granite gaging products, which features a selector chart that simplifies the selection of a surface plate. Three different grades are described. The B grade is a low-cost line being made for the first time. **511**

STRAIN GAGES—Electronics & Instrumentation Division, Baldwin-Lima-Hamilton Corporation, Waltham, Mass. Bulletin 4320, describing SR-4 etched-foil gages with improved design and engineering features. The distinguishing characteristics of foil strain gages are their sensitivity and ruggedness due to the grid structure produced by photoetching extremely thin foil sheets. **512**

WELDING WIRES—Page Steel & Wire Division, American Chain & Cable Co., Inc., Monessen, Pa. Bulletin DH-402-C, describing Page submerged-arc- and inert-gas-welding wires. Featured is a concise description of the uses of twenty-six different analyses of stainless-steel, low-alloy, and mild-carbon-steel automatic welding wires. **513**

CUTTING TOOLS—Arrow Tool & Reamer Co., Troy, Mich. Catalogue featuring several new styles and sizes of heavy-duty ball and other types of end mills available for the first time. The product index has been changed to classify end mills by number of flutes for faster, more convenient references to styles and sizes. **514**

CUTTING TOOLS—Special Cutter & Tool Co., Ecorse, Mich. Catalogue outlining services and facilities for both standard items that are carried in stock as well as special services provided for the metal-cutting trade on their special tools. **515**

BEARING UNITS—Browning Mfg. Co., Maysville, Ky. Catalogue BU-101-B, illustrating and describing Browning's line of take-up units which combine the advantages of modern anti-friction bearings with Browning's exclusive "unbreakable" malleable housing, and rugged welded-steel take-up frames with cadmium-plated adjusting screws. **516**

MEASURING SCALE—Edgar E. Wishaw Industries, Racine, Wis. Circular describing the Detour measuring scale, a simple measuring tool designed to expand the scope and broaden the field of application of the straightedge rule principle for casual measurements in tool and die, pattern making, and general machine-shop practice. **517**

MACHINING CHART—Peter A. Frasse & Co., Inc., New York City. Aluminum machining chart (Sec. G, No. 2) which provides tables of recommended speeds and feeds for six different machining operations: forming, turning, drilling, boring, reaming, and cutting off. A cutting-speed conversion table is included for added convenience. **518**

TUBE FLARING MACHINE—Parker-Hannifin Corporation, Parker Fittings & Hose Division, Cleveland, Ohio. Catalogue 1145-A16, introducing a pneumatically operated machine for forming a double-lap flare on the end of ferrous and non-ferrous tubing. The machine handles tubing of 1/8 through 1/2 inch outside diameter. **519**

MILLING MACHINES—Famco Machine Co., Kenosha, Wis. Two bulletins, one describing Famco mills with three-directional power feed. The second, entitled "Famco True Trace Hydraulic Tracer Mills," describes in detail the great variety of work that can be performed on this machine. **520**

BRAZING FLUX—Stainless Processing Division, Wall Colmonoy Corporation, Detroit, Mich. Engineering data sheet (No. 2.2.3), discussing Nicrobraz Vapo-Flux, which produces good wetting and flow of brazing alloys in marginal or poor dry-hydrogen atmospheres. ...**521**

TAPE CONTROL—Pratt & Whitney Co., Inc., West Hartford, Conn. Bulletin No. 176, presenting the Potter & Johnston tape-control system. Advantages such as reduction in setup and machining time, economy of repeated runs, and increase of machine versatility are covered. ..**522**

GENERAL EQUIPMENT—Syntron Co., Homer City, Pa. 68-page condensed catalogue No. 591, presenting material-handling equipment, parts-handling equipment, power-rectification equipment, mechanical shaft seals, and portable construction tools. **523**

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CLEANING BARRELS—Pangborn Corporation, Hagerstown, Md. Bulletin No. 705, describing the complete line of the company's heavy-duty Rotoblast barrels. Cut-away drawings and sketches show details of the Rotoblast wheel construction, along with special features. . . . **524**

DRILLS—Cogsdill Twist Drill Co., Inc., Greenfield, Mass. 68-page catalogue devoting 44 pages to engineering data—the latest information available on drills and drilling procedures. Covered in these pages are such items as information on drill reconditioning, drilling speeds and feeds, and jig drilling. **525**

DRILL BLANKS—Cleveland Twist Drill Co., Cleveland, Ohio. Folder describing Cleveland "Mo-Max" high-speed, hardened and ground drill blanks. They are offered in fraction sizes from 1/64 inch to 1/2 inch, in wire gage sizes from No. 80 to No. 1, and in letter sizes from A to Z. **526**

COLD-ROLLED SPRING STEEL—Uddeholm Co. of America, New York City. 43-page spring-steel stock list in booklet form listing all standard sizes stocked by the company in a wide variety of Swedish cold-rolled spring steels. **527**

TIME-DELAY RELAYS—A. W. Haydon Co. Waterbury, Conn. Bulletin AWH TD-501, describing a precision time-delay relay for military applications where ease of adjustability, accuracy, and legible time-delay settings are required. **528**

MAGNESIUM ALLOYS—Dow Chemical Co., Midland, Mich. Booklet, "Shop Guide for Elevated-Temperature Magnesium Alloys," describing recommended practices for working magnesium alloys of the thorium and rare-earth-metal families. **529**

CUTTING OILS—Gulf Oil Corporation, Pittsburgh, Pa. Pamphlet presenting ten different types of cutting oils, which provide for every metal-cutting need, including mineral-lard oils, sulphurized-mineral oils, sulphurized-mineral-lard oils, sulphochlorinated-lard oils, and emulsifying oils. **530**

AUTOMATIC TRACING ATTACHMENT—True-Trace Sales Corporation, El Monte, Calif. Bulletin No. STM-1, describing the cost-saving features of "Synchro-Trace," fully automatic, 3D programmed control system for milling applications. **531**

ABRASIVE COATING—Silicones Division, Union Carbide Corporation, New York City. Data sheet, Form SF-1159, noting a 300 per cent increase in the efficiency of grinding wheels when made with Union Carbide A-1100 Silane coating for abrasive grains. **532**

PRESS BRAKES—Dreis & Krump Mfg. Co., Chicago, Ill. Bulletin No. D-59 on the Series D Chicago mechanical press brakes, illustrating and describing the many features, and giving complete specifications of the forty standard sizes in this series with capacities from 90 to 500 tons. **533**

FASTENER FIT—Standard Pressed Steel Co., Jenkintown, Pa. Checklist of fastener ills, entitled "Common Thread-Fit Problems . . . their symptoms and detection," listing seven common fit problems, and gaging devices for detecting them. **534**

MOTOR—General Electric Co., Schenectady, N. Y. Bulletin GEA-6927, describing the company's new Thinline motor, rated from 1 to 5 hp in drip-proof and totally enclosed constructions for limited space applications such as machine tools, fans, blowers, and food disposers. **535**

TRACER CONTROLS—Micro-Hydro Duplicator Division, James Engineering & Machinery Co., Dearborn, Mich. Catalogue entitled "Micro-Hydro Tracers," featuring hydraulic tracer controls, a complete line of duplicators for any type of machine. **536**

METAL LATHES—Delta Power Tool Division, Rockwell Mfg. Co., Pittsburgh, Pa. Catalogue (Form AD-1177) describing the complete line of Delta industrial metal lathes. Featured is the company's 10-inch metal lathe with variable-speed drive and 3/4-inch collet capacity. **537**

SMALL MOTORS—Barber-Colman Co., Rockford, Ill. Catalogue R-1, describing four types of AC shaded pole, reversible, non-geared motors. Complete information on performance characteristics, ratings, construction, dimensions, and typical applications is given. **538**

BALANCING MACHINES—Gisholt Machine Co., Madison, Wis. Catalogue presenting "HS" series of balancers for varied applications—for very accurate, rapid balancing of small high-speed rotating parts or assemblies containing high-speed rotating parts. **539**

AIR MOTOR—Hannifin Co., Des Plaines, Ill. Bulletin 215 describing the air motor line recently introduced by the company. It covers features, specifications, and dimensions for the five bore sizes available in each of four mounting styles. . . . **540**

SPECIAL MACHINES—Logansport Machine Co., Inc., Logansport, Ind. Bulletin No. 7A, covering some of the company's

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special air- and hydraulic-operated machines. 541

DOUBLE-CRANK PRESSES—Federal Machine & Welder Co., Warren, Ohio. Bulletin in color covering the Warco line of straight-side, double-crank presses in capacities from 60 to 400 tons. 542

BALL BEARINGS—Messinger Bearings, Inc., Philadelphia, Pa. Catalogue No. 59, describing the company's "Featherweight" bearings available as either radial, angular contact, or four-point contact bearings. 543

MACHINE CHASSIS—Swanson-Erie Corporation, Erie, Pa. Brochure explaining the advantages of Series B and C turret type indexing machine chassis for special-purpose processing and assembly machines. 544

COUPLING NUTS—Standard Pressed Steel Co., Jenkintown, Pa. Bulletin (Form 2488) describing the first fluid coupling nuts to successfully incorporate positive, self-locking action. 545

GAS GENERATOR—C. I. Hayes, Inc., Cranston, R. I. Bulletin No. 5901-NI, describing the design features and operating economies of the Hayes "Nitro-Gen" generator. 546

VALVES—Homestead Valve Mfg. Co., Coraopolis, Pa. Catalogue discussing a durable-seal hydraulic operating valve, giving data and specifications. 547

ADJUSTABLE - SPEED DRIVE — Louis Allis Co., Milwaukee, Wis. Bulletin No. 2750, featuring the company's redesigned Adjusto-Spede drive in ratings of 3/4 to 7 1/2 hp. 548

METAL FINISHING—Hanson-Van Winkle-Munning Co., Matawan, N. J. Bulletin No. Co-104, describing the company's buffing and polishing compounds. More than 150 compounds and their applications are described. 549

BUSHINGS—Ex-Cell-O Corporation, Detroit, Mich. Catalogue 355811, describing the line of Ex-Cell-O drill jig bushings for use in plastic jigs and fixtures. All standard sizes are listed. 550

CARBIDE THROW-AWAY INSERTS—Pratt & Whitney Co., Inc., West Hartford, Conn. Circular No. 625, pointing out, with illustrations and charts, the features and advantages of the company's carbide throw-away inserts and tool-holders for high-speed turning and boring. ..551

CAP-SCREWS—Allen Mfg. Co., Hartford, Conn. Bulletin No. G-25, featuring the company's larger head-diameter hex socket cap-screws called "'60 Series," which give up to 2 1/3 times more load-carrying capacity without indentation. 552

ASSORTED TOOLS—Brown & Sharpe Mfg. Co., Providence, R. I. 48-page Machinists' Tools Catalogue No. 37M, listing Brown & Sharpe tools generally used by machinists and toolmakers. 553

SURFACE GRINDERS—Landis Tool Co., Waynesboro, Pa. Catalogue CGS-59, describing the full line of the company's abrasive surface grinders. Included are specifications and information on extra equipment. 554

REMOVABLE PUNCHES—Pivot Punch & Die Corporation, North Tonawanda, N. Y. Brochure describing "Cone-Lock," a removable punch to fit every type of tooling —improvement on old-style removable retainers. 555

COOLANT DISPENSER—Major Die & Engineering Co., Chicago, Ill. Circular featuring "Handicup," a device for dispensing coolant, that can be mounted on every variety of machine tool. 556

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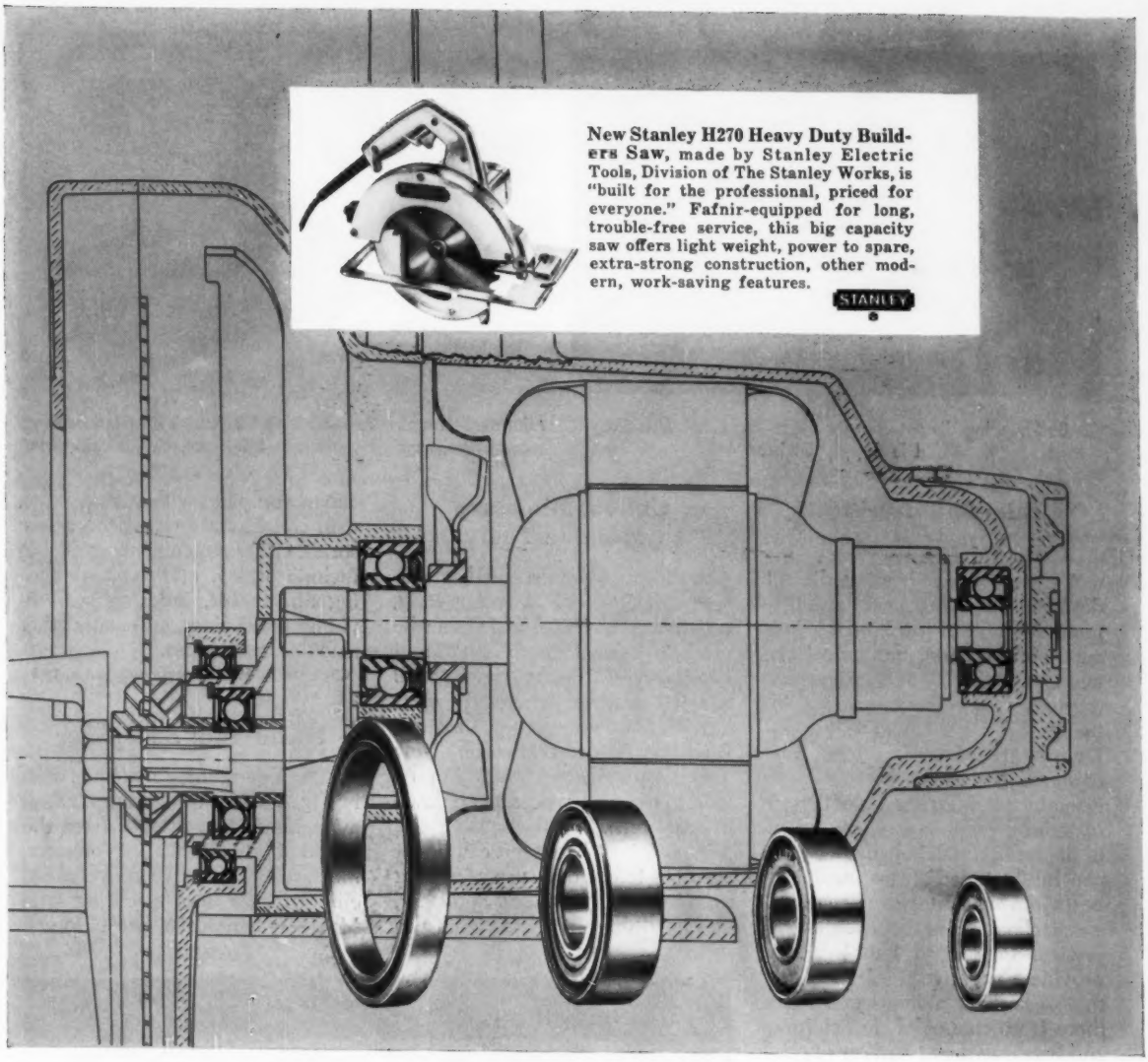


New Stanley H270 Heavy Duty Builders Saw, made by Stanley Electric Tools, Division of The Stanley Works, is "built for the professional, priced for everyone." Fafnir-equipped for long, trouble-free service, this big capacity saw offers light weight, power to spare, extra-strong construction, other modern, work-saving features.

STANLEY

New Stanley power saw, Fafnir ball bearing equipped, designed to deliver nearly 40% more cutting force!

Armature, saw shaft, even the blade guard Fafnir-mounted for free-starting, no-maintenance, heavy-duty performance

Nearly 40% more cutting force at working speeds, with 27% less operator effort! This new Stanley power saw represents a design achievement of the first order. And to insure long, efficient service life, Stanley makes generous use of Fafnir precision ball bearings. Even the blade guard is Fafnir-equipped (with an aircraft type bearing), for responsive action at the slightest pressure. On the armature and saw shaft, Fafnir ball bearings all but eliminate friction and wear. Bearing maintenance is eliminated, too. Various combinations of seals and shields lock out contaminants, lock in factory-packed lubricant. No danger of faulty or neglected lubrication... virtually no chance of bearing failure.

Take advantage of Fafnir's "designer's approach" to bearing problems. You'll find Fafnir's breadth of experience and diversity of line insure precise answers. Write The Fafnir Bearing Company, New Britain, Connecticut.

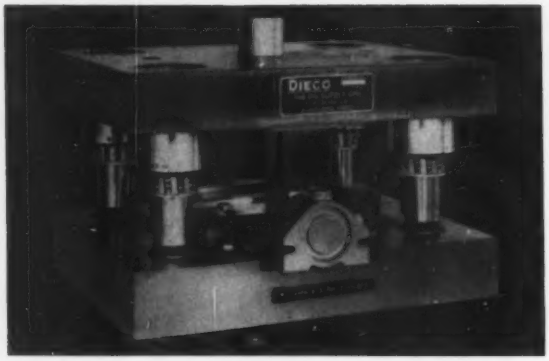
Sealed and shielded Fafnir ball bearings meet specific service requirements in Stanley saws

Felt seal and shield (Motor Armature)

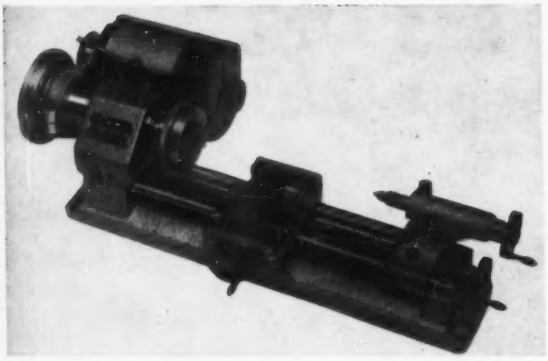
2 Plya-Seals (Blade Guard)

Plya-Seal and shield (Saw Shaft)

FAFNIR BALL BEARINGS



Ball-bearing die set brought out by the E. W. Bliss Co., Die Supply Division



Miniature combination machine for model and laboratory work announced by American Edelstaal, Unimat Division

Bliss Ball-Bearing Die Set

A patented ball-bearing die set designed to assure positive alignment of punches and dies, eliminate burred parts, reduce rejects, and extend the life of dies between regrinds has been announced by the E. W. Bliss Co., Die Supply Division, Cleveland, Ohio. This equipment is said to be so easy to assemble and disassemble that it materially reduces the time spent in die building and change-over. It can be "stripped" from the guide posts, an advantage when used on inclinable and straight-side presses. Pre-loaded ball bearings provide "negative clearance" so that even after millions of strokes there is no chance of dies shifting and breaking down because of misalignment.

"Slots" machined at an angle in the bearing retainer offset each ball by 4 degrees and prevent vertical rows of ball bearings from "tracking," which tends to wear an impression into the bushing. Stepped projections in the retainer prevent the sudden shock which often occurs as an entire horizontal row of ball bearings is brought into preload at one time.

Ball bearings are installed in the punch-holder, not in the die shoe. Adjustable locating pins in the ball-bearing assembly permit the use of the same die set on presses with different strokes, or the locating pin can be set to strip from guide post at shortest minimum shut height. The die can then strip at this height for all strokes.

Circle Item 593 on postcard, page 193

Unimat Miniature Machine Tool

An ingeniously designed, miniature machine tool 16 inches long, called the "Unimat," which can be used to advantage in shop and laboratory for machining small model and experimental parts has been announced by American Edelstaal, Unimat Division, New York City. Machine work can be held to close tolerances, even down to 0.004 inch.

The Unimat basic unit can be set up as a lathe, drill press, milling machine, tool grinder, polisher, and hand drill. The basic unit also comes complete with motor, lathe, drill chuck, and other lathe accessories. Other attachments available include jigsaw, table saw, threading attachment, indexing and dividing attachment, and many other machine accessories.

Circle Item 594 on postcard, page 193

Heald Tool Sharpener

A tool-sharpening machine, seen in Fig. 1, for metal-cutting tools is available in two designs from the Heald Machine Co., Worcester, Mass. Model 3 is for conventional elliptical tip tool grinding and Model 4 handles either elliptical

Fig. 1. Heald tool-sharpening machine

How a leading automotive manufacturer Snyder-izes for the Soaring Sixties

HOLDS PISTON WEIGHTS ± 2 GRAMS AT 600 PER HOUR

This Snyder transfer machine automatically weighs die cast aluminum pistons and mills them to tolerances of ± 2 grams at double the rate of the previous method. Here's how it turns out 600 parts per hour:

Pistons are transferred bottoms-up to orienting station.

Pistons are oriented in relation to the wristpin hole offset.

Pistons are spun right side up (below at right) while they are advanced to weighing station.

Precise overweight is transmitted by memory system to weigh-mill station during transfer.

A 3¼" milling cutter removes excess with the piston clamped in position.

Gaging station re-weighs pistons to check weight. Deviation from part tolerances stops machine.

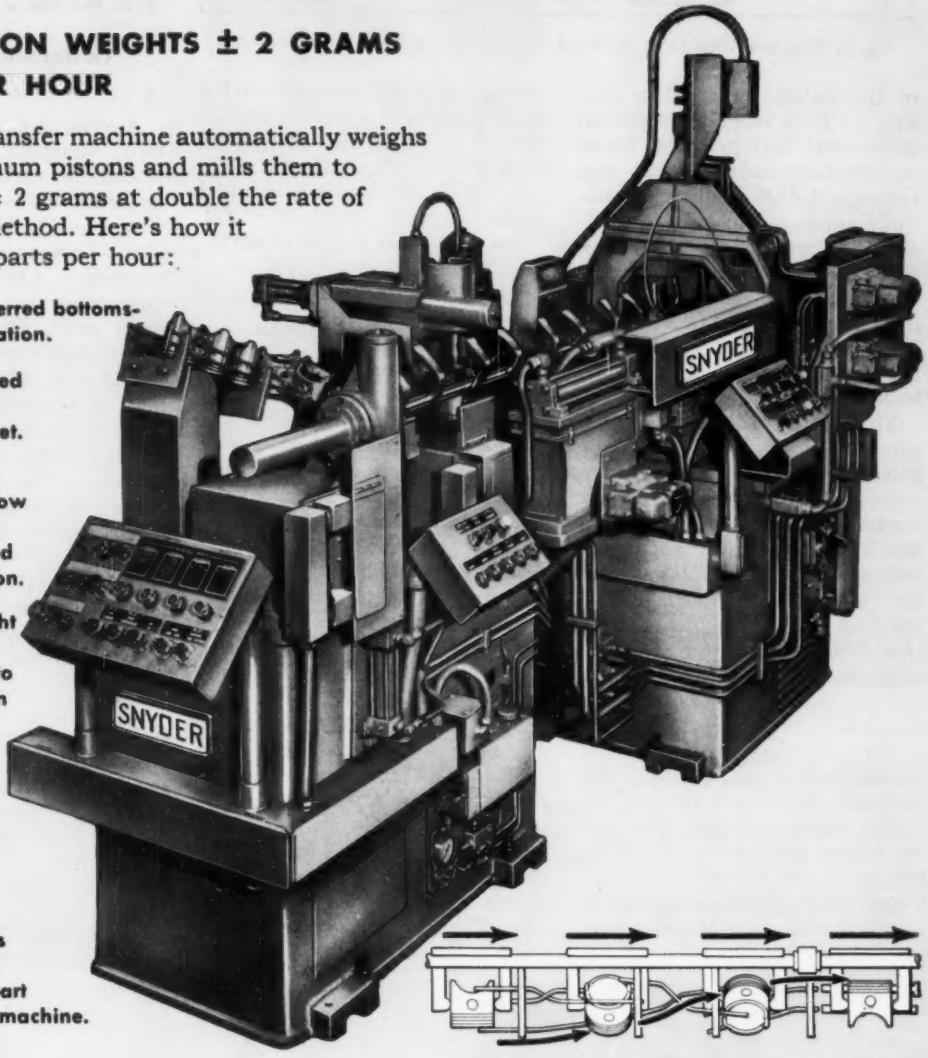


Diagram shows end over end rotation of piston as it passes through spiral rails.

Do your manufacturing cost problems revolve around parts handling, gaging and assembly as well as machining? Ask us to show you the benefits of SNYDER-IZING FOR THE SOARING SIXTIES. For a resume of SNYDER special machines engineered for profit opportunities, send for our new brochure or phone.

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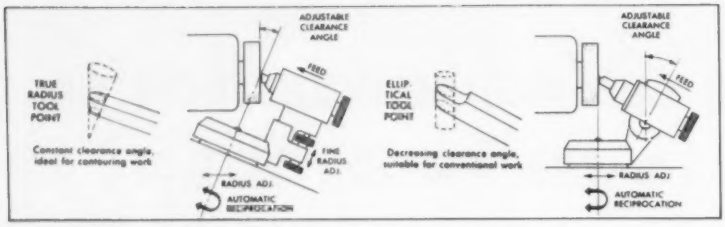

Fig. 2. Diagrams illustrating elliptical and true-radius tip grinding methods

or true-radius tip grinding (see Fig. 2.) Both models provide an economical, high-precision means of grinding carbide-tipped and high-speed-steel cutting tools. Fully automatic reciprocation assures uniform and repetitive tool-tip accuracy and permits one operator to tend several machines at the same time. An offhand grinding attachment at the left end of the unit is standard equipment on both models.

The Model 4 tool-sharpening machine designed for true-radius grinding provides greater accuracy where the tool is used in machining contoured shapes in which contact varies about the tool tip with the configuration of the work-piece. In true-radius grinding on the Model 4 tool-sharpening machine, the clearance angle is obtained by setting the axis of tool-holder oscillation at the desired angle, thus generating a conical surface. As a result, in contour-boring or turning, the clearance angle and the tool-tip radius remain constant although the cutting point moves about the tool tip. A tool-holder for conventional, elliptical tip sharpening is supplied with each Model 4 machine. Where tool contact with the work remains at a given point, the Model 3 Heald tool-sharpening machine for elliptical-point tools offers substantial savings in initial cost.

Circle Item 595 on postcard, page 193

Actuator for Operating Air Chucks and Collets

A "PowerGrip" actuator designed to close a machine tool chuck or collet, which eliminates the need for a rotating union and provides power for holding either bar or chucking work, is announced by PowerGrip, Inc., Rockfall, Conn. This actuator has been developed to eliminate air leaks and vibration and reduce down time for repairs. It is adaptable to automatic operation. When combined with automatic work-loading and unloading devices, it can eliminate the need for an operator.

The chuck actuator is a non-rotating air or hydraulic cylinder, mounted on ball bearings. The cylinder's thrust is transmitted through the bearings to the machine's rotating spindle and draw tube. There is no flywheel effect, no limit on spindle speeds, and no delicate, rotating air seal to heat up and leak. The actuators are made in several standard sizes, with piston diameters ranging from 4 3/4 to 12 inches in diameter and in other sizes to meet special requirements.

Circle Item 596 on postcard, page 193

Collapsing Taps for Pipe Threads

A series of Class "ST" collapsing taps designed for producing smooth threads on especially tough materials has been introduced by Geometric-Horton, New Haven, Conn. These taps are similar to the company's Class "S" collapsing taps except that they have a semi-taper action for tapping NPT or NPTF pipe threads.

The semi-taper mechanism permits the chasers to recede during the tripping action, greatly reducing the cutting stress as the full threads are being formed. It also eliminates completely the stop-off lines usually left by jam-cut tapping. This is essential for certain gas and fluid threaded connections in order to prevent leakage. Actually, the thread is produced with this tap by the jam-cut principle up to the point of tripping, after which the semi-taper mechanism functions just before collapsing the chasers. Class "ST" taps can be purchased in all sizes of the Class "S" series. The general dimensions of these taps are exactly the same as those of the Class "S," and they use standard Class "S" chasers.

Circle Item 597 on postcard, page 193

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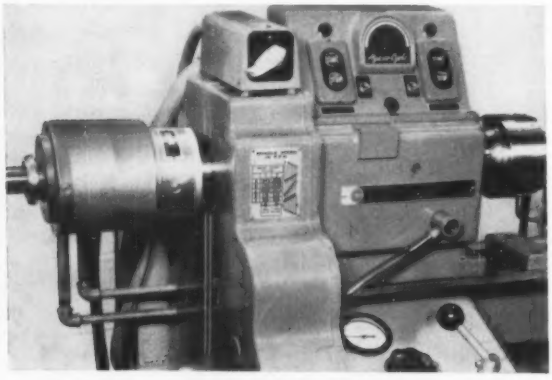
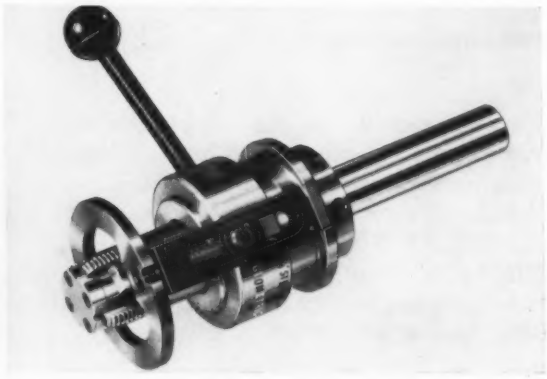


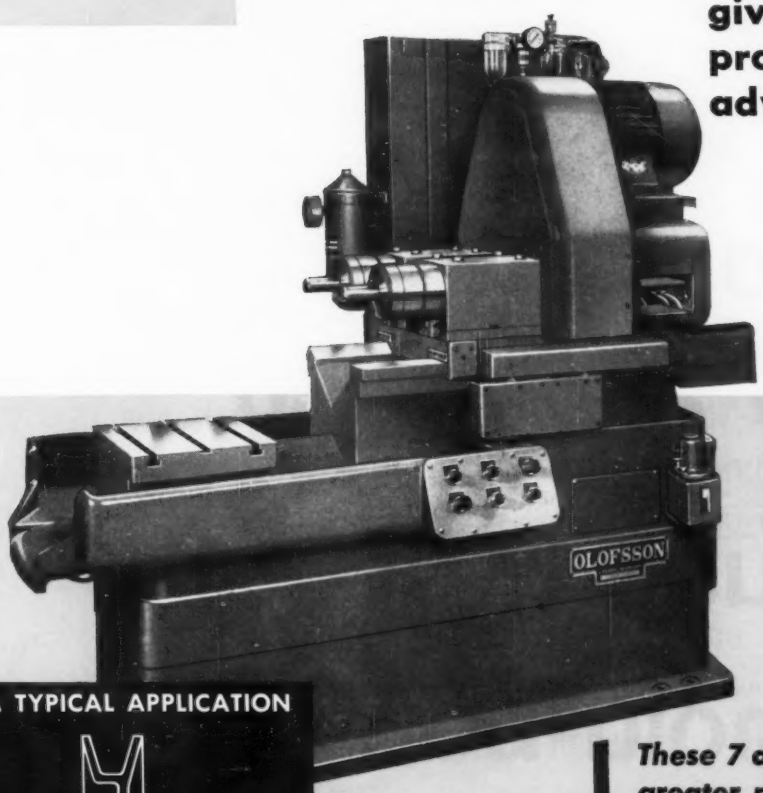
PowerGrip actuator for closing chuck or collet shown applied to machine tool



Geometric-Horton semi-taper action collapsing taps for producing pipe threads

NEW design

OLOFSSON Precision Boring Machine gives added production advantages



OLOFSSON Model 30-012 Single End Precision Way Boring Machine

PROVIDES FAST, ACCURATE ROUGH AND FINISH BORING, FACING, CHAMFERING, TURNING AND GROOVING.

A TYPICAL APPLICATION

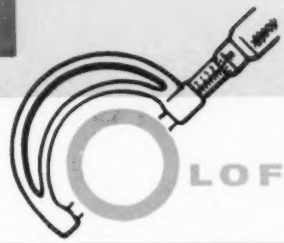
Finish bore, turn o. d., groove, and chamfer zinc die-cast pulley.

Rate of Production: 190 pieces per hour.

These 7 design features give you greater production efficiency . . .

1. New design provides low height to width ratio of spindles to ways.
2. Self contained hydraulic unit, separate from machine, for easy maintenance and elimination of heat problems.
3. Standard commercial hydraulic components throughout.
4. Nickel-iron, one piece ribbed base with integral fixture mounting pad and chip disposal basin.
5. Hardened and ground ways.
6. Conveniently located push-button control panel.
7. Forced feed lubrication.

FIND HOW THE 30-012 FITS YOUR REQUIREMENTS. WRITE FOR LITERATURE.



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2729 Lyons Ave., Lansing, Michigan

MANUFACTURERS OF PRECISION BORING MACHINERY AND SPECIAL MACHINERY

Important new discovery for users of resinoid-bonded diamond wheels

YOU CAN DEPEND

The Diamond Research Laboratory has just completed one of the most exhaustive research projects ever conducted in the diamond abrasives field. A total of 700 pounds of hardest carbide was ground. Over an eight-month period, 600 separate tests were run with 145 resinoid wheels. These tests were made to evaluate a completely new type of natural diamond grit.

The results are impressive: from 30% to 50% longer wheel life than was possible with the old natural grit. Why the spread? Because there's no such thing as an average job, so you can't strike an average figure. But whatever the job, this new natural grit is a vast improvement.

Selected Natural Diamond (SND-RESINOID) was researched especially for users of resinoid-bonded wheels. This grit will be available to your wheel manufacturer. Next time you order a resinoid wheel, specify SND-RESINOID. He'll know what you mean.

ON NATURAL DIAMONDS

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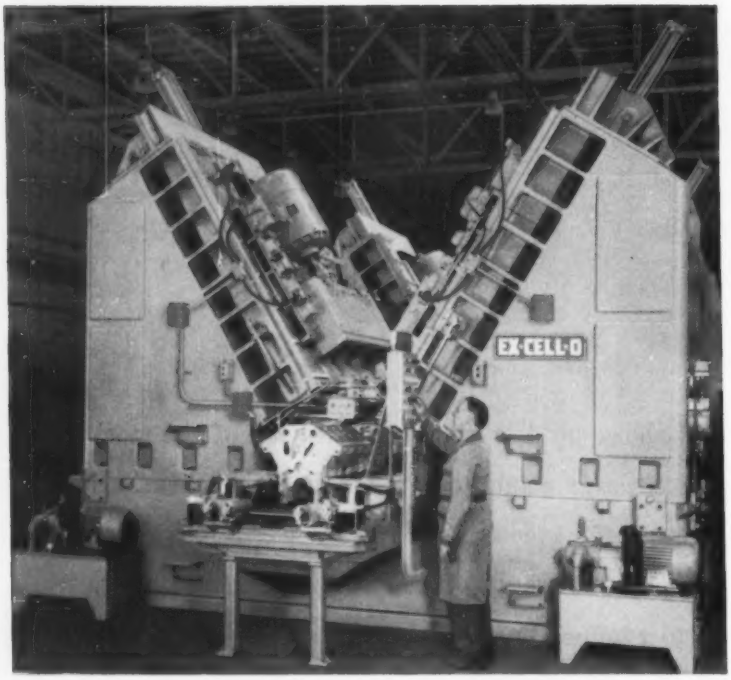


Fig. 1. Ex-Cell-O cylinder-boring machine built to rough-bore cylinder blocks

Huge Cylinder-Boring Machine with Rotac Actuators

The largest cylinder-boring machine ever built by the Ex-Cell-O Corporation, Greenville, Ohio, has just been completed. This huge machine, Fig. 1, is equipped with three Rotac torque actuators that clamp the cylinder blocks in the fixture. These actuators, like the one shown in Fig. 2, are built by the Ex-Cell-O Corporation in its Greenville plant. They supply ample torque, yet occupy little space. The massive machine, 18 feet wide and more than 15 feet high, rough-bores six-, nine-, and twelve-cylinder diesel-engine blocks. A minimum of time is required in making change-overs to accommodate the various sizes.

The Rotac actuators operate cam type clamps, which have floating clamping members. Blocks are clamped downward from the top. Hydraulic jacks, positioned in series on both sides, prevent any weaving movement of the part during the heavy cut.

The three standard Rotac RN-34-2V-DE torque actuators utilize only 350 to 500 psi of the 1000 psi capacity under normal conditions. The actuators in this application are loaded in torque only.

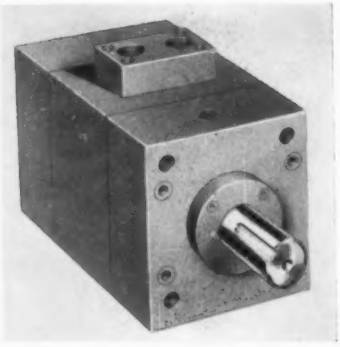


Fig. 2. Rotac actuator of type used to clamp cylinder blocks in machine shown in Fig. 1

Circle Item 598 on postcard, page 193

"Ideal" Quick-Change Tool-Holders

The Concord Engineering & Mfg. Co., Los Angeles, Calif., is introducing a new style of quick-change tool-holder, designated "Ideal," which was originated in Western Germany. The company has taken over the manufacture of this tool and redesigned it to suit the needs of the American market.

The tool-holder, Fig. 1, engages the toolpost over a large, highly finished, profiled cylindrical area.

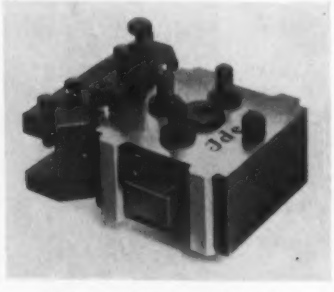


Fig. 1. "Ideal" tool-holder

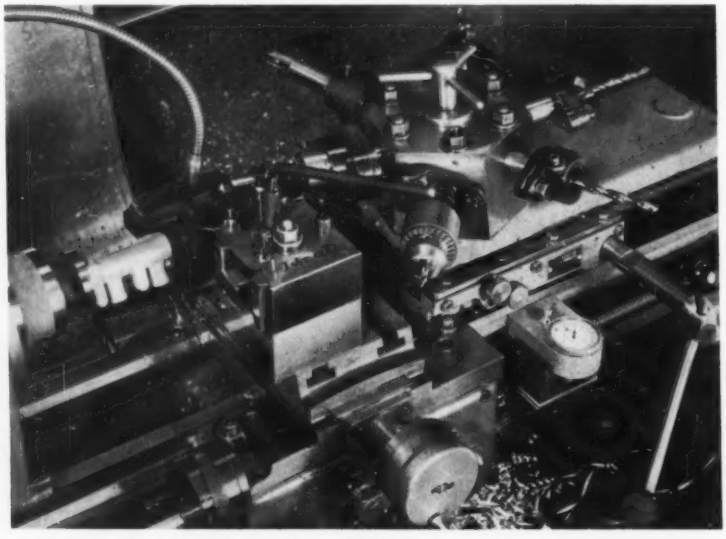
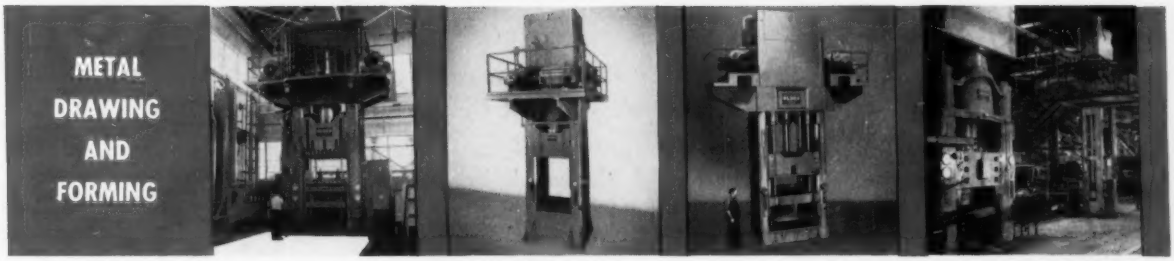
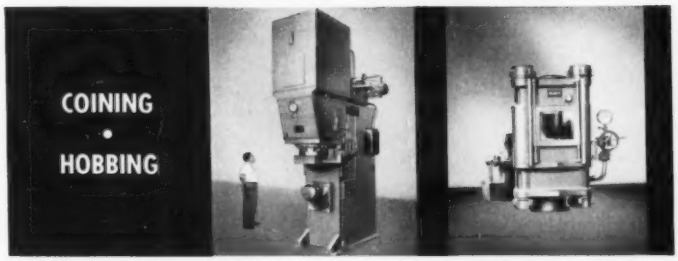


Fig. 2. Concord turret lathe equipped with "Ideal" tool-holder

For YOU, too . . .

Elmes can turn pressing problems into profit-making performance!





Elmes Engineering vision and know-how have provided hundreds of cost-reducing press installations like these during more than 60 years of leadership in specialized hydraulic service.

In some cases, a standard-design Elmes® Press met all the job needs. In others, simple modifications were made in the basic press design. In still others, a special "custom built" press was developed to meet unusual production requirements. But in every case the press was Elmes "Job-Fitted"—*the right press for the job.*

Elmes experience and ingenuity can bring the same profit-producing transformation into your shop. Talk it over with your Elmes Distributor, or write us direct.

Elmes American Steel Foundries
ENGINEERING DIVISION

1162 Tennessee Avenue, Cincinnati 29, Ohio
METAL-WORKING PRESSES • PLASTICS MOLDING PRESSES • PUMPS • ACCUMULATORS

For more data, circle this page number on inquiry card

This area is independent of the locking mechanism and is accurate in all three coordinates to 0.0001 inch.

The tool-holder block assembly is so mounted on a turret lathe, as shown in Fig. 2, that it becomes practically an integral part of the compound rest. The heavy, sturdy tool-holders grip the tool bits firmly, in most cases over practically their entire length, by means of four set-screws.

The center hole of the tool-holder block is fitted with a soft bushing which can be drilled to size, if necessary, to accommodate existing fittings. The tool-holder is made as a standard stock item for lathes with swings ranging from 10 to 100 inches.

Circle Item 599 on postcard, page 193

Equipment Designed for Automatic Deburring of Gear and Sprocket Teeth

A new concept in the automatic deburring of the teeth in gears and sprockets, which combines the use of coated abrasives with a machine tool operation, has been announced by Minnesota Mining and Mfg. Co., St. Paul, Minn., and Barber-Colman Co., Rockford, Ill. Two major advantages claimed for the method are: consistency in profile from tooth to tooth and from gear to gear, as well as complete protection for the gear face.

The deburring is accomplished by a specially designed, formed "PG" wheel such as seen in Fig. 3. This wheel is moved by hydraulic action into the working position and automatically fed into contact with the gear, as indicated in Fig. 2. The wheel is retracted to the starting position at the end of a pre-specified contact period—all on a push-button-controlled cycle of the Barber-Colman machine, Fig. 1. The wheel and gear spindles operate in a timed relationship so that the work indexes one tooth for each revolution of the wheel.

The "PG" wheel is made of hundreds of die-cut leaves of coated abrasive—in this instance, aluminum-oxide mineral resin-bonded to a cloth backing—fabricated into a wheel and locked at the hub with aluminum flanges.

Production models of the machine, Fig. 1, manufactured and sold by Barber-Colman, will employ "PG" wheels in the 6- to 14-inch diameters, and the Model 1600 will accommodate gears up to 16 inches outside diameter. Larger-capacity machines can be built. The coated abrasive method completely removes the burr around the entire tooth form, and can be used to produce a controlled chamfer where required. In addition to the formed-wheel version of the process, in which a "PG" wheel is preformed to the exact shape of the work-piece, the new method permits the use of an oscillating "PG" wheel which requires no forming. The wheel does, however, have several annular slots, as shown in Fig. 4, which provide increased flexibility. A feature of the oscillating method is that the rotation of wheel and work-piece need not be in a timed relationship. Finish is about the same except that

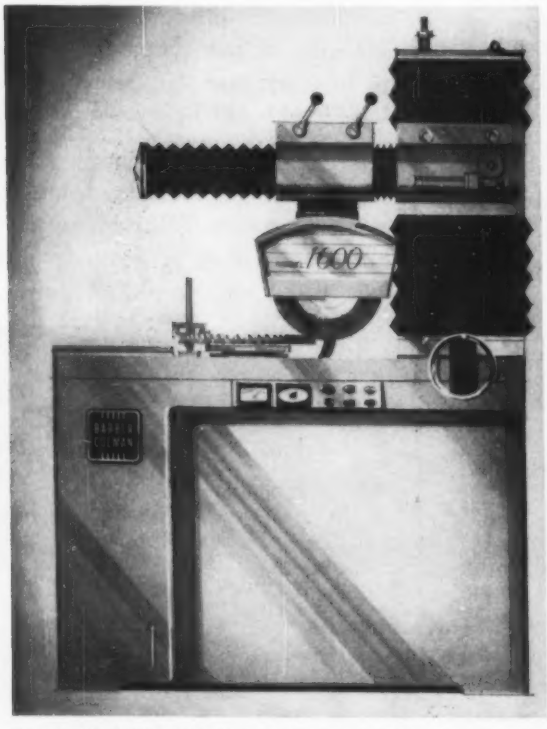


Fig. 1. Model 1600 Barber-Colman gear-deburring machine using "PG" wheel for deburring helical and spur gears

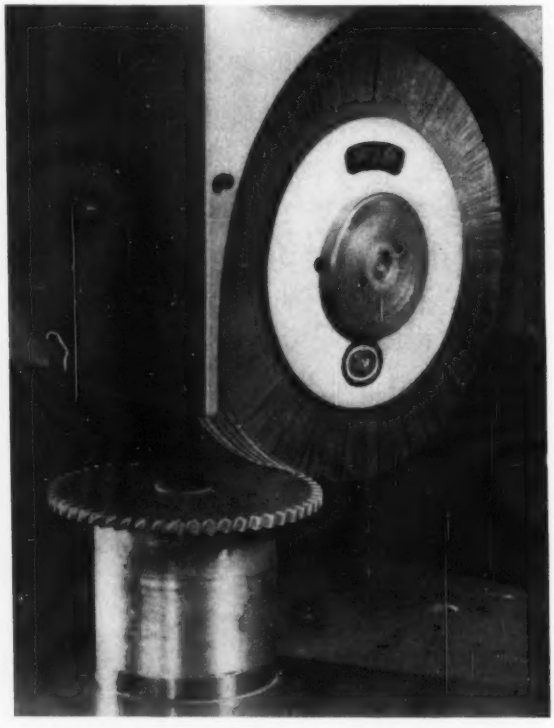
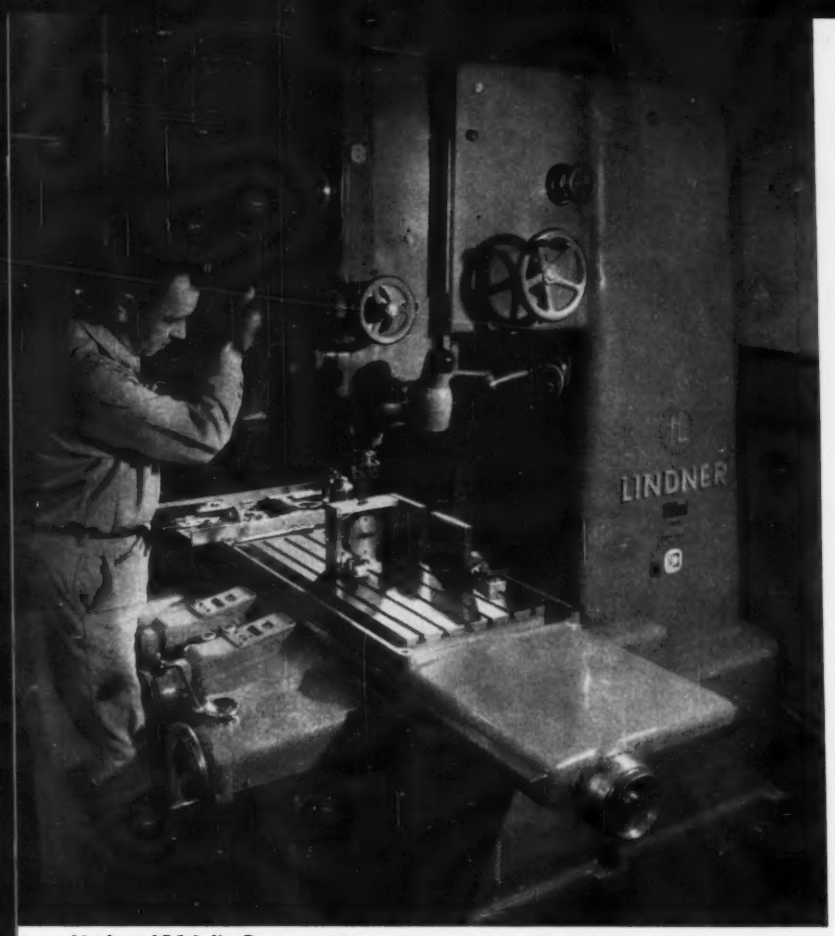
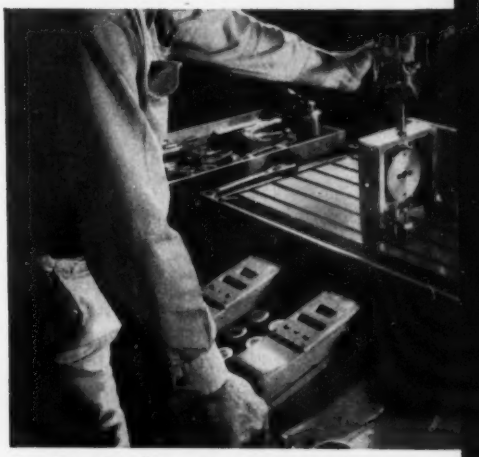


Fig. 2. Close-up of formed "PG" wheel which is rotated in timed relationship with the gear being deburred



Lindner LB14 Jig Borer at Philips Electronics, Inc., Mount Vernon, N. Y., has 32" x 16" table. Also available in larger model, LB15A with Autopositioner®—Table 44" x 24".

Precision Production—Boring 20 holes in the specimen plate cover of the Norelco Model 100KV Spectrograph. Done in one set-up. Time: 2 hours. 30% *faster than previous methods!*



Precision Tooling—Boring holes in a drill jig for the Norelco Powder Camera. Opposite holes must be aligned within .0001".

How the Lindner Optical Measuring System brings greater precision to jig boring

at Philips Electronics, Inc.

A jig borer can be no more accurate than its measuring system. And in the Lindner the problem of maintaining *permanent* accuracy has been solved by the machine's unique *fully optical* measuring system.

No lead screws. No gage blocks. No bars or limit switches. The helically scribed, cylindrical measuring scales in every Lindner are touched by a light beam only. These scales are independent of the table movement mechanism and *immovable* in axial direction. Thus, the whole system is permanently protected against any mechanical wear whatsoever. Lifetime accuracy!

Visual fatigue and errors in settings are minimized by a photo-electric centering device. It makes possible initial and repeat settings guaranteed accurate within .00015" over the full length of travel and readings in .00005".

There's no eye strain or bending. A helical line from the measuring scale is projected onto a 2½" wide screen which the operator reads from a standing position. No eyepiece required.

That's why Philips Electronics—like so many other precision producers—relies on the Lindner for tooling, production and inspection of its Norelco atom measuring equipment and other precision research tools.

The Lindner optical measuring system is changing ideas about jig boring all over the country. We've packed all the facts into a meaty 25-minute movie film. Send for it today without obligation. Or write for literature.

KO CO., INC. PRECISION MACHINERY

KURT ORBAN

COMPANY, INC.

Exchange Place, Jersey City 2, New Jersey

the oscillating wheel (Fig. 4) produces a slightly larger, less precise chamfer than does the formed wheel (Fig. 3). Production models of the deburring machine will utilize either method.

The "PG" wheel provides a clean deburring or finishing operation because the abrasive mineral and the cloth backing wear away together. This action assures a sharp wheel at all times since fresh mineral grain is always being presented to the work. Because the coated-abrasive leaves tend to become firmer or stiffer as they grow shorter, there is no need to vary the speed of the wheel to compensate for the smaller diameter and the decreasing perimeter velocity. Even as the diameter of the wheel becomes smaller, it remains in timed relationship with the work.

The "PG" wheel (such as shown in Fig. 3) is formed in the user's plant. A Type C disc is cemented to the face of the work-piece. The overhanging part of the disc is then cut away to expose the gear teeth which serve as a forming tool. The wheel is then forced into contact with this forming tool until the proper form is imparted to the wheel.

Circle Item 600 on postcard, page 193

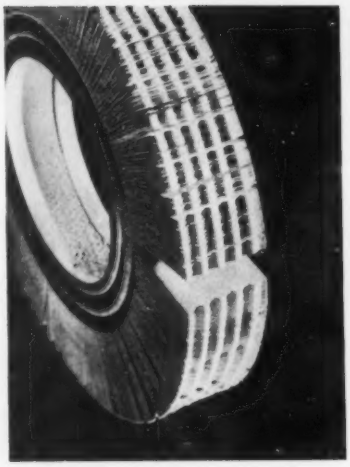


Fig. 3. "PG" wheel formed to mesh with a particular gear design for deburring operation

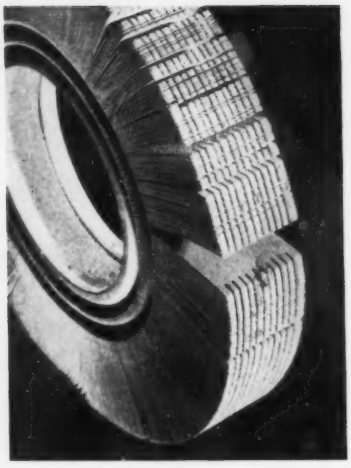


Fig. 4. "PG" wheel which has annular slots for use with the oscillating method of gear deburring

Detector for Missing or Broken Drills

A pneumatic-drill detector unit for use with multiple- or single-station automatic drilling machines, that "spots" broken and missing drills and supplies a signal for machine shut-down, is available from the Sheffield Corporation, Dayton, Ohio, a subsidiary of Bendix Aviation Corporation. This device is unaffected by dirt or coolant. The continuous jet of air blowing against the drill helps to keep it clean and free of chips as well as detect broken reamers, taps, and other types of tools. It is now being used in mass-production plants to eliminate separate probing stations.

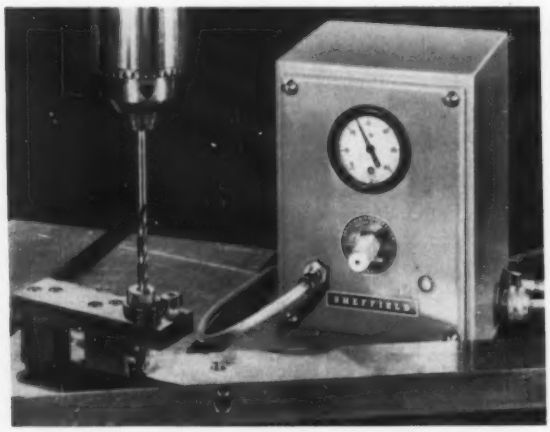
The unit detects the presence or absence of a tool by means of a stream of air playing against the tool as it enters or is retracted from the work-piece. A broken or missing drill causes a pressure drop in the pneumatic circuit which, in turn, initiates an electrical impulse to operate signal lights and relays.

Any number of modular type units can be mounted on a single control panel. The unit operates off the factory air line and a 110-volt, 60-cycle alternating-current circuit.

Circle Item 601 on postcard, page 193

Electronic Checking Gage

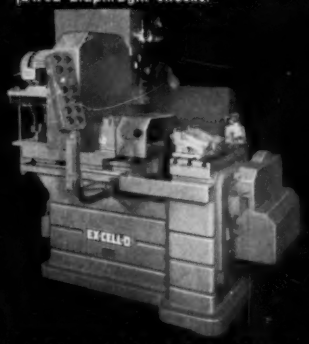
Deviations as small as ten-millionths of an inch in the curvature or contour of inner and outer bearing races can be detected by an "Accutron" electronic gage recently announced by the Sheffield Corporation, Dayton, Ohio, a subsidiary of Bendix Aviation Corporation. This instrument can be



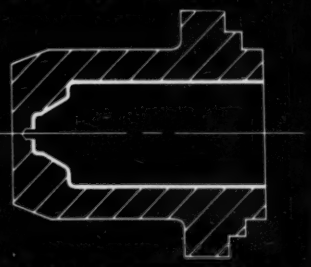
Sheffield drill detector unit with simulated automatic drilling setup

Sheffield electronic gauge for checking curvature of bearing races

LEFT—Closeup photo shows the .003" radius boring tools and the size of the parts held in the three-jawed diaphragm chucks.



ABOVE—The Style 308 Cam-Operated Precision Boring Machine used in this high-output machining operation.



ABOVE—Cutaway, twice actual size of the part, shows contour of the finished cut. Surface finish is held to 12 RMS.

59-20

BORES AND CONTOURS 184 PARTS PER HOUR

Style 308 Cam-Operated Precision Boring Machine finishes small stainless steel parts to 12 RMS

Speed and precision in continuous, close-tolerance production of contoured parts come easy to this Ex-Cell-O Cam-Operated Precision Boring Machine. Direct cam action makes it possible. Two cams are mounted on a single shaft; one acts directly on the cross slide follower, the other on the table follower. There are no levers. Changing the cams changes the form for the next job—in minutes.

Style 308 (illustrated) and the larger Style 312 hold the parts in one or more spindles, tools are mounted on the cross slide. The machine above uses such a setup to straight-bore and generate the inside contour of 184 parts per hour, two at a time.

If you are anxious to get a similar production process underway quickly and economically, start now by calling your local Ex-Cell-O Representative. Or, if you prefer, write direct.

EX-CELL-O FOR PRECISION XLO

EX-CELL-O CORPORATION
DETROIT 32, MICHIGAN
Machinery Division

EX-CELL-O PRECISION PRODUCTS INCLUDE: MACHINE TOOLS • GRINDING AND BORING SPINDLES • CUTTING TOOLS • RAILROAD PINS AND BUSHINGS • DRILL JIG BUSHINGS • TORQUE ACTUATORS • THREAD AND GROOVE GAGES • GRANITE SURFACE PLATES • AIRCRAFT AND MISCELLANEOUS PRODUCTION PARTS • DAIRY EQUIPMENT.

used also to inspect the radius of other types of precision parts. Equipped with standard components, the gage checks race curvature of inner and outer bearing rings from 3/8 inch to 6 inches outside diameter. This range covers bearings with balls from 1/16 to 5/8 inch in diameter. With additional components for miniature bearings, the gage will check inner rings with outside diameters from 0.050 to 0.500 inch. Outer rings with inside diameter from 0.075 to 0.500 inch can also be checked.

Circle Item 602 on postcard, page 193

Kingsbury Automatic for Processing Levers for Automatic Transmissions

A multiple-unit automatic machine, Fig. 1, that performs ten operations from three directions on levers for automatic transmissions like the one shown in Fig. 2, has been built by the Kingsbury Machine Tool Corporation, Keene, N. H. Ten units drill, ream, countersink, tap, press in a pin, and spin over the metal at a gross production rate of 210 parts per hour. A 30-inch index-table holds six work fixtures. Because the work is difficult to locate and clamp properly, each fixture is provided with three rams. Clamping and unclamping are accomplished automatically through the use of air cylinders.

Four vertical units drill, rough-ream, countersink top and bottom, and finish-ream the center hole. A special recessing tool does the countersinking. Two horizontal units are each located 16 degrees to the left of the radial center lines. One unit drills and countersinks the hole at the left with a combination tool and the other unit taps it.

Horizontal units for the hole at the right are each located at an angle of 35 degrees to the right of the radial center lines. The first unit drills and the second one reams the hole. A special assembly unit operated by an air cylinder presses in a pin. The final unit spins over the metal to make a slight burr so that the pin will not fall out.

Circle Item 603 on postcard, page 193

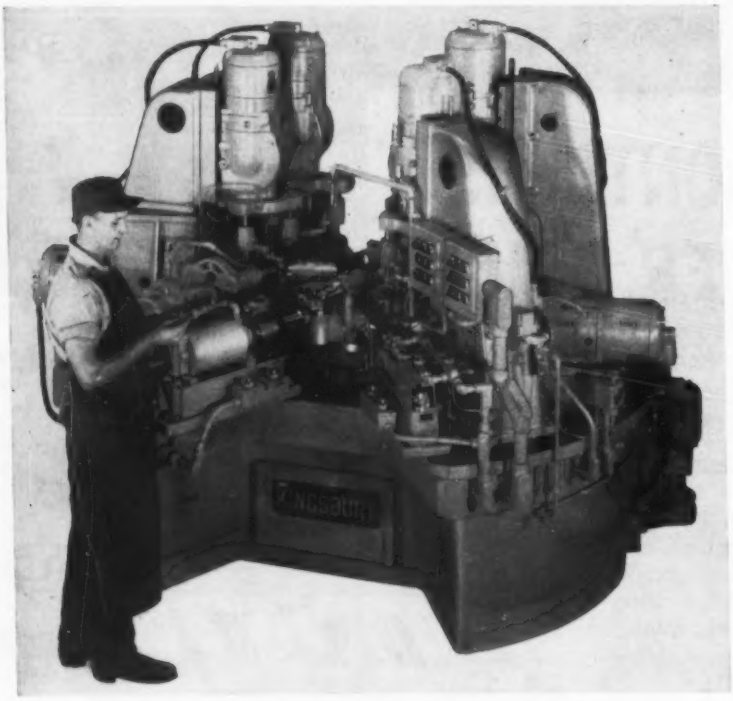


Fig. 1. Kingsbury machine built to automatically perform ten operations on lever shown in Fig. 2

S.P.V. reversing tapping attachment announced by Homestrand, Inc.

Homestrand Reversing Tapping Attachment

Homestrand, Inc., Larchmont, N. Y., has added a reversing tapping attachment, designated SAR-100, to its S.P.V. line of tapping equipment. This attachment features a torque clutch that can be easily adjusted by hand. No forces are imposed on the tap when the "over-running" clutch is disengaged. Friction-free axial movement permits the tap itself to serve as a lead-screw. This attachment has been designed to eliminate tap breakage and enables the tap to consistently cut accurate threads.

Circle Item 604 on postcard, page 193

(This section continued on page 212)

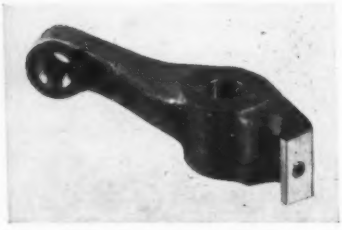


Fig. 2. Automatic-transmission lever processed by machine shown in Fig. 1

This 24" floor model drill tailored for toolroom work includes Infispeed drive and 42" x 24" table.

Buy your new medium duty 16" or 24" CINCINNATI Sliding Head Drill just as you want it—with selected specialized equipment factory-installed and tested! Buy only the cost-saving combination you need to suit your toolroom, production or job shop requirements EXACTLY!

NEW BACK-GEAR SPINDLE DRIVE

7½ to 1 ratio Back-Gear—12 spindle speeds with Standard drive, infinite selection with Infispeed. Full torque over entire 60—3000 RPM range. Controls at front of machine.

INFISPEED VARIABLE SPEED DRIVE

Provides exact spindle speed for each job. Indispensable for operations requiring frequent spindle speed changes.

NEW BUILT-IN ELECTRICAL TAPPING ATTACHMENT

Manual tap reversal by hand feed lever; automatic reversal by depth stop.

NEW PRECISION DEPTH STOP

Direct-reading dial permits quick settings to .005". Positive stop for sensitive hand feed; automatic disengagement when used with new "torque-load" power feed precision controlled to .005".

OTHER COMBINATIONS include Geared and Air Power Feeds, Manual and Automatic Work Holding Fixtures, Wide Selection of Plain or T-Slotted Work Tables, Variety of Spindle Types and Sizes, Motor Driven Coolant Pump, and other Cost-Reducing Attachments.

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Improved Machining Through Research

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"TRAY-TOP" Lathes / "CINCINNATI" Drilling Machines / "SPIROPOINT" Drill Sharpeners

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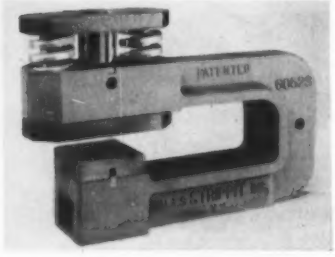
High-Accuracy Comparator

An electronic comparator, capable of detecting dimensional variations of one-millionth of an inch, has just been announced by Federal Products Corporation, Providence, R. I. Known as Model 130 B-12, it was originally developed for measurement of master and working gage-blocks in Federal's own gage laboratory. Because of its exceptional accuracy, ease of operation, and comparatively low cost, it is well adapted for use in any gage laboratory where high-order measuring accuracy is required. It can accurately measure gage-blocks as large as 4 inches. Its electronic amplifier provides four magnifications (2000 to 1, 6000 to 1, 20,000 to 1, and 60,000 to 1). Graduations are 0.000030 inch, 0.000010 inch, 0.000003 inch, and 0.000001 inch, respectively.

Federal gage-block comparator

The precision-ground reference platen is fitted with two sets of three balls which provide an accurate three-point reference surface for comparing gage-blocks. The balls are spaced in one set to accommodate square blocks. The other set takes rectangular blocks. Another type of anvil, one side serrated, the other plain and lapped flat, may be used for other parts.

Circle Item 605 on postcard, page 193



Strippit Punching Unit

Press-actuated hole-punching unit of dual-range capacity announced by Wales-Strippit, Inc., Akron, N. Y. The punch diameter capacity of this unit can be quickly altered from 0.250 to 0.750 inch in mild steel by changing the stripping mechanisms. Consisting of a single heavy-duty holder for both capacity ranges, it has a readily removable punch assembly and two lift-out stripping springs. With Strippit mechanical springs in place, the unit has a stripping pressure suitable for the lower-capacity work. By replacing these with Strippit Hydra-Springs, the stripping pressure is greatly increased.

Circle Item 606 on postcard, page 193

Tool for Re-Working Car Wheel Sets

Kendex tool for re-working mounted car wheel sets on Niles wheel-turning lathes and Sellers tracer-controlled wheel lathes, developed by Kennametal, Inc., Latrobe, Pa. This tool, designed for indexable, clamped, throw-away inserts, is made in five styles for Niles turret type and rigid tool-block lathes, and in two styles for Sellers lathes. Tools for flange-roughing and contouring tread and flange are provided for left- and right-hand machining on these lathes. A special tool for removing mushroom rollover is available for the Niles turret tool-block lathe. Square inserts provide up to eight indexable cutting edges. Heat-treated alloy steel tool-holders have Kennametal seats.

Circle Item 607 on postcard, page 193

Insert Tool-Holders for Tracer Lathes

One of a line of "Lift-O-Matic" tracer tool-holders designed to fit nearly all tracer lathes, announced by the Metallurgical Products Department, General Electric Co., Detroit, Mich. These tool-holders use a specially designed, elongated, 55-degree diamond-shaped dispos-

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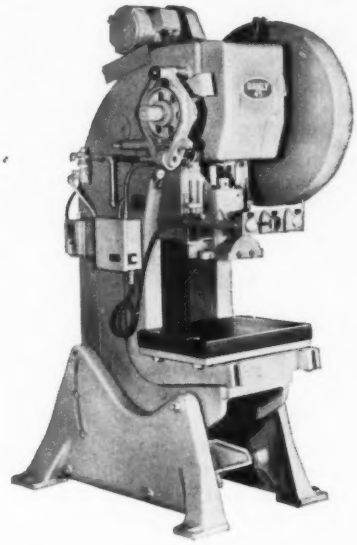
The Leading Supplier to the Stamping Industry

in PRESSES



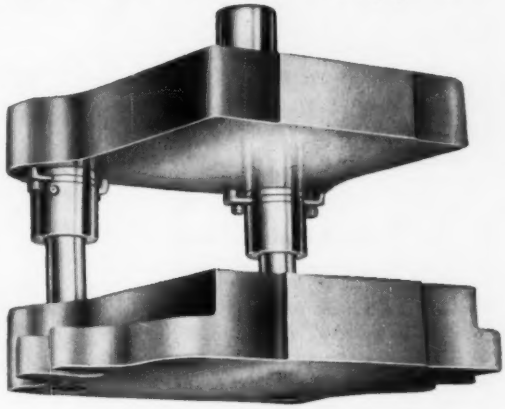
The report of the Business and Defense Service Administration shows that Danly led all producers of presses during 1957. Industry made Danly the first choice because you get lower operating costs with a Danly Press—you can depend on it! Each press is engineered to turn out more accurate stampings . . . to produce more units per shift . . . and to reduce profit-eating maintenance and spare parts inventories.

There are many new developments you should know about, such as the Quick Die Change feature available on all Straight Side Presses . . . single, double and triple action . . . the modern high-production Autofeeds . . . and the completely modern line of Open Back Inclinable presses just introduced. See how Danly can help you reduce costs and give your products the stamp of leadership!

Shown above: *New Danly O.B.I. Press.* Each model of this new press line (25 to 200 tons) has the exclusive Danly Air Clutch and Brake to assure continuous production and long press life.

Write for new O.B.I. Press catalog that gives complete information on features and specifications of these reasonably priced presses.

in DIE SETS and Die Makers' Supplies



Danly is now working on its fifth million in die set production. Included in this production are many die sets for the automotive industry—that are working in that industry in its multi-million car production of today.

In every instance, Danly can meet your most exacting diemaking specifications with a die set—standard or special. Since pioneering the first mass-produced precision die sets 36 years ago, Danly has continuously developed new production, inspection and distribution methods to serve you better.

Today, there's the new Danly Die Set with Demountable Bushings being assembled in a factory branch or distributor assembly plant near you. It is your fast, convenient source for toolroom and pressroom supplies that bear the stamp of leadership. Danly facilities for special Die Set manufacture are also improved and expanded

Shown above: *New Danly Demountable Bushing Die Set*—the most accurate Die Set on the market today. The ease of assembly and disassembly offers important advantages in die making and die maintenance.

Send for money-saving facts. Write us and your distributor or branch will give you helpful information on Danly Die Sets.

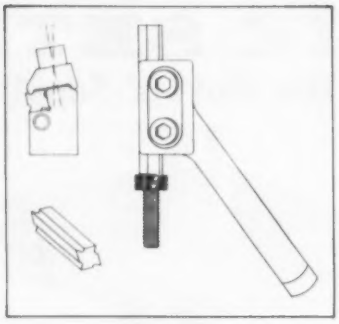
DANLY MACHINE SPECIALTIES, INC.

DANLY®

2100 S. Laramie Avenue, Chicago 50, Illinois

able insert that is said to resist pull-out even when facing or machining a shoulder. The precision-ground inserts can be supplied in negative or positive rakes in Carboloy grades 883, 78B, 350, and 370 to cover nearly all machining needs.

Circle Item 608 on postcard, page 193



Tool-Holder with Four-Sided Bits

A tool-holder using four-sided bits of high-speed steel, Stellite, or carbide has been announced by 4 Side Tools, Berkeley, Calif. These tools combine a tool bit and chip-breaker all in one. The clearance and rake angles are pre-established in the tool-holder to give a free-cutting action and a short chip. The four-sided bits are sharpened merely by squaring their ends. Tool-blocks can also be furnished to adapt this tool for use in screw machines, turret lathes, automatics, and drill presses.

Circle Item 609 on postcard, page 193

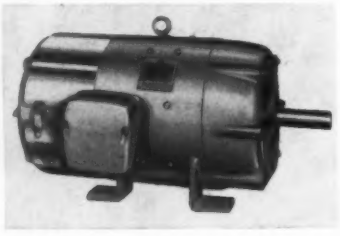
Barber-Colman Tachometer Generator

Reversible shaded-pole motor designed to fulfill the requirements for an alternating-current tachometer or rate generator. With rated alternating-current voltage applied to the main winding, a voltage is generated in the shading windings which is proportional to the speed at which the rotor is driven. Voltage is nearly linear from 1000 to 3000 rpm. Generated voltage from a typical AYAE rate generator with low-impedance shading coils (150 ohms) is 2 volts per thousand revolutions per minute and can be increased to 10 volts per thousand.

Circle Item 610 on postcard, page 193

Louis Allis Direct-Current Motors

One of a line of direct-current motors, called "Flexitorq," developed by the Louis Allis Co., Mil

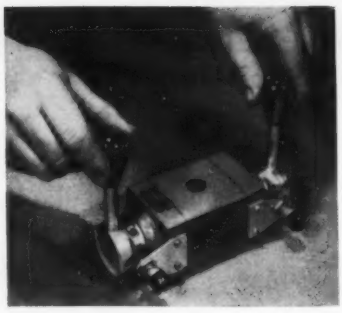


waukee, Wis., to provide faster response, a wider speed range, and higher overload capacity in a lighter, more compact unit. These motors are available in ratings of 1 to 200 horsepower, in drip-proof and drip-proof-guarded enclosures. They are designed to supply constant or adjustable speed for driving machine tools, metal-rolling, drawing or forming machines, cranes, hoists, conveyors, dynamometers, test stands, and special automated machinery.

Circle Item 611 on postcard, page 193

Clark Hydraulic Valve

Double hydraulic valve introduced by the Clark Engineering & Mfg. Co., Racine, Wis. This valve is available in three- and four-way combinations. Sizes cover a range of capacities from 2 to 40 gallons per minute with detented or spring-return handles. CEM-LAP seals, mating with optically flat rotor surfaces, assure positive sealing at 2500 psi for oil and 2000 psi for water and gas.



Roller thrust bearings assure smooth action and low handle pressures. Motor starting switches can be added as shown for alternating- or direct-current operation.

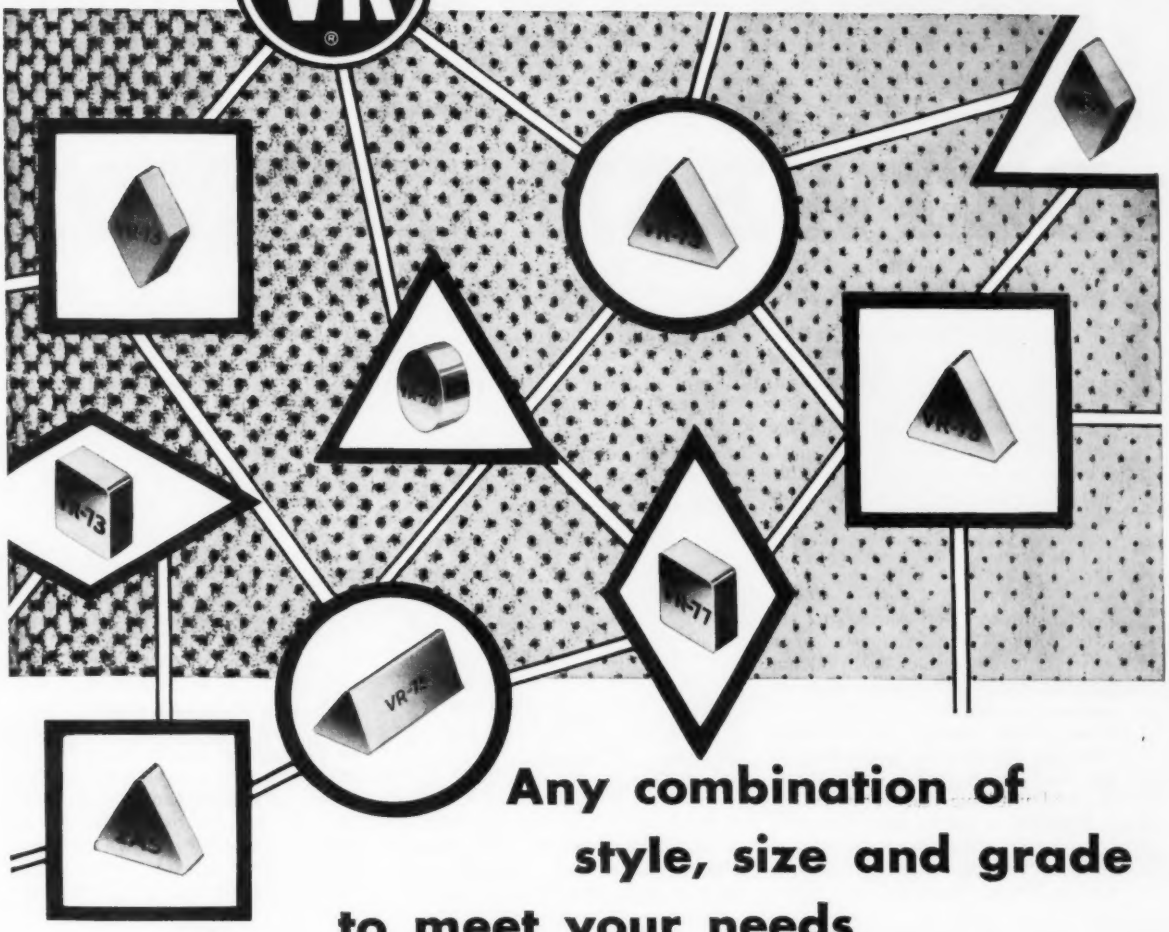
Circle Item 612 on postcard, page 193

Miniaturized Linear Ball Bushings

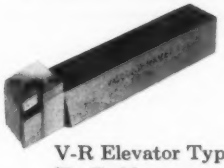
Miniature linear ball bushings of line produced by Thomson Industries, Inc., Manhasset, N. Y. This line of bushings enables major reductions to be made in both the size and weight of critical instruments and accessories of vital importance in the missile and aircraft industries. The ball bushings, designated INST-258 and INST-396, are designed for use on shafts 0.1246 and 0.1871 inch in diameter. They have an outside diameter of 0.3125 inch, and are made in lengths of 0.5, 0.375, and 0.562 inch, respectively. They weigh only 0.15 and 0.30 ounce. Despite their small size, each bearing contains three complete ball circuits. Each circuit contains sixteen balls in the smaller size. The larger size has seventeen balls.

Circle Item 613 on postcard, page 193

V-R carbide inserts...



Any combination of style, size and grade to meet your needs



V-R Elevator Type Toolholder.

V-R Solid Base Type Toolholder.

Complete machining flexibility is possible only when you can get exactly the right combination of carbide insert grade, size and style . . . when you need it. That's why V-R manufactures the *most complete line* of inserts available anywhere. Regardless of the operation to be performed or the type of material to be machined, there's a V-R carbide insert that's best for your job. Ask your V-R representative. He will be glad to show you how V-R's complete line can provide fast answers to your cutting tool problems.

Send for Catalog VR-58 for complete details.

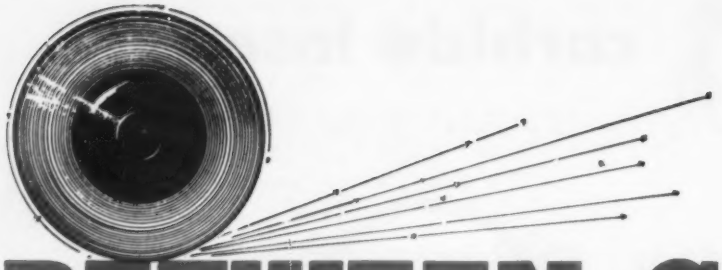
Vascoloy-Ramet corporation

PRIME MANUFACTURERS OF REFRACTORY METALS ENGINEERED FOR THE JOB

C-743

868 Market Street • Waukegan, Illinois

For more data, circle this page number on inquiry card



By E. S. Salichs

BETWEEN GRINDS

They Get the Message

An automatic guide system is being used at the National Gallery of Art. Visitors may rent a special transistor radio with an earpiece; as they walk through exhibitions, they are informed about selected paintings. The truly artistic will probably ignore automation, which is as it should be.

Auto Aids

The director of purchasing at Buick says, "We get requests in our Division for everything from talcum powder to paper cuspidors—from molasses to crushed walnut shells—from dental mirrors to dynamite. One day recently we got a request for the 'Missing Link.' That had us stopped until we discovered that a missing link is just an open link used by maintenance men to repair chains." You can figure it out—the talcum in some finish-polishing operations; the molasses to form cores in the foundry; the walnut shells for shot-blast cleaning; the cuspidor . . . Another item might be mentioned—500,000 aspirin tablets a year for the company hospital. After all, there *are* headaches in the automobile-building business.

The Mixer that Fixes

Report has it that an ingenious adapter is available which changes the kitchen mixer into a 1/4-inch drill. The sequel to this—or what happens when the little woman turns around to mash potatoes and finds she is drilling holes in the pot—will probably make for another report.

Meeting of Minds Over Mica

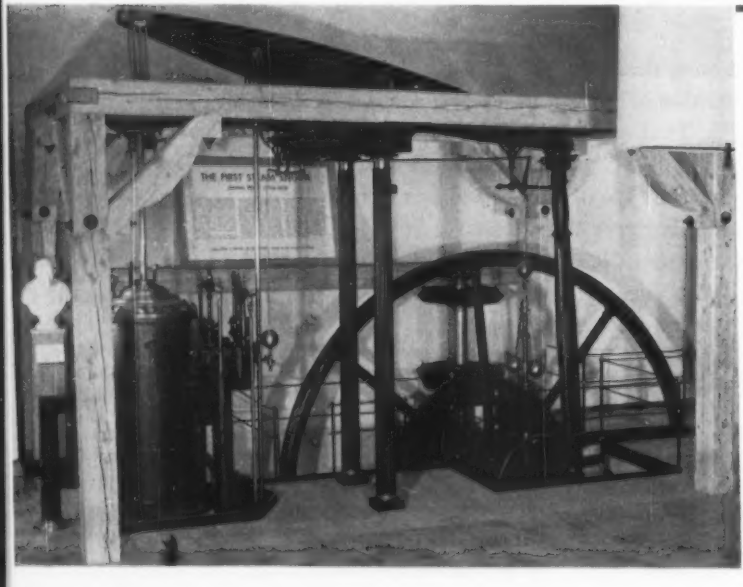
Finding a substitute for mica is a project of several research organizations, one of them being Horizons Incorporated. Mica is scarce, expensive, and important in the electrical and electronic fields. I guess that's why they slice it so thin.

Gosh, It Had Better Gush

The National Supply Co. has figured that it takes 1,456,195 pounds of steel in equipment to drill an oil well 10,000 feet deep.

Cook by Card, or Filet on File?

At the International Home Furnishings Show last year, automation in cooking meals at home was demonstrated. The housewife chooses a meal suggested on a perforated card, places the food ready for cooking on the burners and in the oven, inserts the card in a master control panel on an appliance wall, then takes off to play bridge, tennis, or golf. As yet, the wall has not been manufactured for sale, but man, it sounds better than those TV dinners.



MACHINE HEAVEN—This original James Watt steam engine, built in 1799, was operating in an English textile mill until 1945 when it was replaced by a diesel engine. The DoALL Co. was fortunate enough to obtain this historical and priceless engine for its Hall of Progress, which opened to the public in May, in Des Plaines, Ill. Dismantling the engine was a problem, according to the plant manager, since "the engine was, literally, part of the building and in some cases was probably holding up the building." Watt began making rotative engines in 1782 for turning mill machinery in textile and flour mills. Here, for the first time, they replaced horses. Therefore, the number of horses replaced became a measure of the engine's performance, and Watt charged annual premiums based on the equivalent horsepower his engine exerted.

Lincoln

WELDYNAMICS

NEWS ABOUT ARC WELDING AT WORK CUTTING COSTS

Oil well pump chain housing is positioned for flat welding with Jetweld. Welding speed is doubled.

OIL FIELD PUMPING UNITS NOW WELDED TWICE AS FAST

Doubling welding shop production without increasing their investment in labor or machines was accomplished by the Parkersburg Rig and Reel Company at Coffeyville, Kansas.

This firm manufactures oil field pumping units. The complete structure of these units is welded and varies in size depending upon the requirements of the well on which they are to work. Bases are fabricated from as small as 8″ 17 lb. beams to as large as 14″ 68 lb. beams. One exceptionally large unit used a 36″ 210 lb. member for the walking beam.

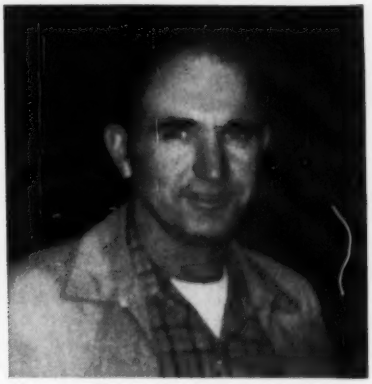
Under the supervision of Jess Kern, Plant Manager and Sammy Doss, Welding Foreman, tests were conducted in the Parkersburg shop in an effort to increase welding efficiency.

A Lincoln welding engineer, Robert Clipsham, surveyed the welding operation. He studied the procedures used and conducted tests with various electrodes and equipment.

The survey indicated that with minor positioning changes almost every weld could be made with a faster, easier-operating iron-powder electrode.

Parkersburg is now using Jetweld 1 electrodes almost exclusively. Mr. Doss says, "Jetweld is twice as fast as the conventional electrodes we were using. It gives us better looking welds, mileage per rod is greater, and weld cleaning is much easier and faster."

Completed chain housing mounted on base fabricated from I beams.



Sammy Doss, Welding Foreman at Parkersburg Rig and Reel has switched to Jetweld almost exclusively.

For help with welding procedures and cost reduction ideas call your Lincoln welding engineer today.

NEW WELDER TAILORED TO YOUR NEEDS

The new Lincoln Idealarc "TM" welder has been designed to meet the needs of any shop.

The key to the "TM" model's versatility is a wide range of options that expand the uses for the machine.

These new Idealarcs are available in 300, 400, 500 and 650 amp sizes.

Bulletin 4607.1 has all the details. A copy may be obtained by writing The Lincoln Electric Company.

The LINCOLN ELECTRIC CO.
Dept. 1234 • Cleveland 17, Ohio
The World's Largest Manufacturer of Arc Welding Equipment

For more data, circle this page number on inquiry card

News OF THE INDUSTRY

California, Colorado, and Texas

JOSEPH T. RYERSON & SON, INC., Los Angeles, Calif., announced that Reynolds aluminum has been added to its stocks and that complete service on aluminum, in addition to its service on steel, is being given to metal consumers in the southern California area. Heading aluminum sales is BRUCE I. SMITH.

UNION TWIST DRILL CO. of Athol, Mass., and the S. W. CARD DIVISION of Mansfield, Mass., announce the appointment of MACHINISTS' TOOL & SUPPLY CO., Los Angeles, Calif., as their authorized distributor.

AIR REDUCTION SALES CO., New York City, a division of Air Reduction Co., Inc., has announced the completion of a new oxygen and nitrogen plant at Denver, Colo. with WILLIAM O. BROWN in charge. LEO C. JONES will be superintendent.

RALPH A. CASTILLO has been appointed general manager of Joseph T. Ryerson & Son, Inc., Houston, Tex.

Connecticut, Massachusetts, and Vermont

NEW DEPARTURE, a division of General Motors Corporation, Bristol, Conn., announces that DR. RICHARD H. VALENTINE became director of research and development with this division and was succeeded as its chief engineer by PETER WALLACK. Both will report directly to FREDERICK J. GARBARINO, director of sales and engineering.

New Departure's engineering facilities and personnel are now divided into two distinct units. One, in the charge of Mr. Valentine, is concerned with research and development, as well as new products activity. The other, headed by Mr. Wallack, is involved in regular product-engineering work. JAMES J. CREAMER became an assistant sales manager at New Departure, transferring from the duties of sales zone manager in Cleveland to the GM Division's home office at Bristol, Conn. His successor in Cleveland is JOHN P. KEANE.

Francis L. Dabney, executive vice-president, the Bullard Co.

THE BULLARD CO., Bridgeport, Conn., has announced the re-election of E. P. BULLARD III as president and general manager and the promotions of FRANCIS L. DABNEY to executive vice-president and PAUL L. SMITH to secretary and treasurer.

PRODUCTO MACHINE CO., Bridgeport, Conn., has appointed CLINT HELTON & CO., 142 Broadway, Denver, Colo., distributor for Colorado, New Mexico, Wyoming, and part of South Dakota. The company has also appointed MACHINISTS TOOLS & SUPPLIES, INC., Dallas, Tex., distributor for the northern half of Texas. They will be area distributor for Producto in southern Texas, New Mexico, Louisiana, and parts of Arkansas and Oklahoma. Machinists Tools & Supplies, Inc., is located at 1307 Chemical St., Dallas. TENNESSEE DIE SUPPLY CO., 314 Howerton St., Nashville, Tenn., has been appointed distributor for Tennessee and parts of Kentucky, Alabama, Arkansas, and Mississippi.

THE HARTFORD SPECIAL MACHINERY CO., Hartford, Conn., has announced the appointment of HARVEY L. SPAUNBURG, JR., as vice-president of manufacturing, ROBERT A. BODE as vice-president of sales, and FRANCIS A. CARR as factory manager.

SCOVILL MFG. CO., Waterbury, Conn., has announced the expansion of its tube business with the opening of its $10,000,000 tube mills in New Milford, Conn.

NORTON CO., Worcester, Mass., has appointed two new abrasive engineers in its field sales organization. They are RICHARD B. HARDY, who has been named for the metropolitan Philadelphia area, and STEPHEN W. ANDERSON, who has been appointed for Wisconsin, Minnesota, and North Dakota. He will make his headquarters in Minneapolis. GILBERT R. BLAKE has been appointed product safety engineer, succeeding RALPH N. S. MERRITT who has retired after a Norton career of thirty-six years. ROY T. H. WIFFIN has been appointed to the Product Safety section to assist Mr. Blake. PETER B. MARSHALL has been appointed supervisor of sales training. WENDELL H. CHENEY has been named supervisor of recruiting, in which post he succeeds Mr. Marshall. CHESTER N. PEARSALL and K. DALE SWANSON have been appointed field engineers by the company following their completion of the sales training course. Mr. Pearsall has been assigned to the Pittsburgh District Office, and Mr. Swanson reports to the Pacific Coast District Office at Los Angeles.

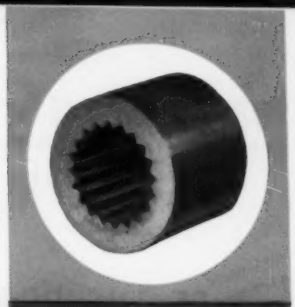
BOSTON GEAR WORKS, Quincy, Mass., has announced promotions and new assignements for its two former assistant general sales managers. WILLIAM J. JOHNSON has been appointed manager, field sales, and EDWARD P. WILLIAMS is now manager, internal sales. JAMES M. MCCORMACK has been named assistant to manager, field sales, and ALFRED M. WORSDELL, assistant manager, internal sales.

L. S. STARRETT CO., Athol, Mass., announces the appointment of four new salesmen to its sales staff. D. F. RICHARDS will serve in the Cleveland territory. W. E. GILLIS will be located in the Los Angeles branch. W. E. STAVELEY moves to Atlanta, Ga. P. T. WICKHAM will locate in the western New England territory.

ROGER W. COWLES, JR., has been appointed by the Cogsdill Twist Drill

Another Meta-Dynamics Division development in

"Chipless machining"!



Ratchet
Material—AISI C-1020
Operation—Form I.D.
Production—300/hr.

Heat exchanger tubing
Material—Copper
Operation — Form fins
Production — 16″ of tubing formed per minute.

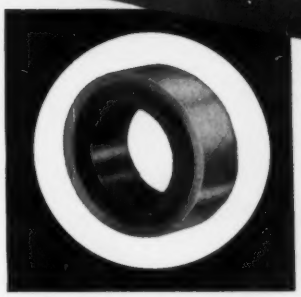
NEW CINCINNATI Intraform

Rapidly produces complex internal profiles to close tolerances, with low cost tooling.

This new *chipless machining* method makes possible low cost production of parts having intricate I.D. profiles that would be difficult or time consuming to machine by conventional methods.

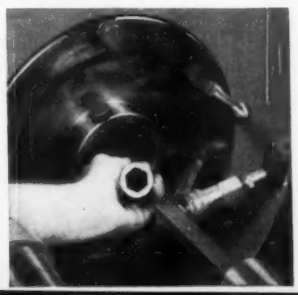
Hollow cylindrical stock, ferrous or non-ferrous, with open or blind holes, is placed over a mandrel and "kneaded" by rapidly pulsating, rotating dies. The smooth, continuous kneading action redistributes the metal to reproduce the profile of the mandrel in the I.D. of the part. The work is formed to close tolerances and with fine surface finish. Tensile strength and hardness of the metal are also improved.

Work diameters ranging from ⅛″ to 5″ can be cold formed on standard Cincinnati Intraform machines, which can also be used for bonding laminated tubing and for reducing and tapering solid or tubular stock. For a description of the process and its many advantages, write for Bulletin M-2060, or call in a Meta-Dynamics Division field engineer.



Laminated tubing
Material — Aluminum and copper
Operation—Bond copper lining to aluminum tube
Production — 24″ of tubing bonded per minute.

Left photo shows workpiece prior to Intraform operation. Note mandrel in front of part. Right photo shows workpiece after Intraform operation with profile of the mandrel reproduced in I.D. As workpiece feeds and mandrel does not, only a short, relatively inexpensive mandrel is required. Time for this operation was 16 seconds.



Intraform
META-DYNAMICS DIVISION
Machines for Metal Forming and Heat Treating

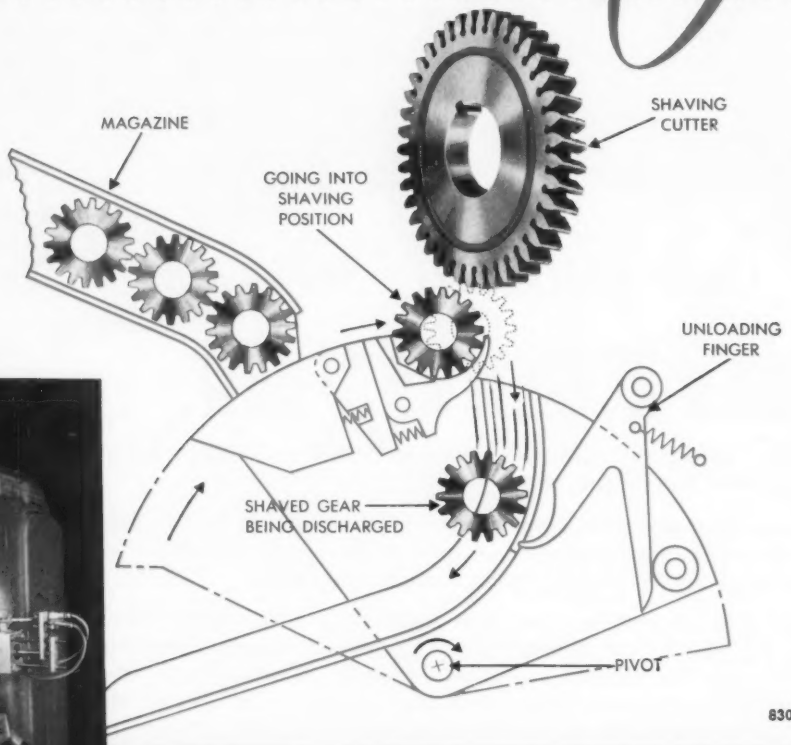
THE CINCINNATI MILLING MACHINE CO.
Cincinnati 9, Ohio, U.S.A.

CINCINNATI

WHY SETTLE FOR ONLY 75%

OF THE PRODUCTION YOU CAN GET WITH

AUTOMATIC GEAR SHAVING



RED RING ROCKER-TYPE AUTOMATIC LOADER
(PATENTED)

Production you can expect from automated gear shaving is determined by the type of automatic loader you use.

You get maximum production when the loader moves a gear from the magazine into shaving position and discharges its shaved predecessor — **all at the same time.** This assures maximum cutter operation.

If, on the other hand, the loading of a fresh gear has to wait until the previous gear has been discharged, shaving is delayed and you get only about 75% of the production you could otherwise expect.

The standard Universal Red Ring Gear Shaving Machine may be automated for MAXIMUM PRODUCTION — and without any major revisions in its design. Write for details.

SPUR AND HELICAL GEAR SPECIALISTS
ORIGINATORS OF ROTARY SHAVING, GEAR HONING AND ELLIPTOID

NATIONAL BROACH & MACHINE CO.

5600 ST. JEAN • DETROIT 13, MICHIGAN

WORLD'S LARGEST PRODUCER OF GEAR SHAVING EQUIPMENT

AMERICAN STANDARD DRIVING AND SPINDLE ENDS FOR PORTABLE AIR AND ELECTRIC TOOLS—3

(Percussion Tools Excluded)

Approved as American Standard October 29, 1958

III. Threaded Fastener Drives

1. Hexagonal Chucks

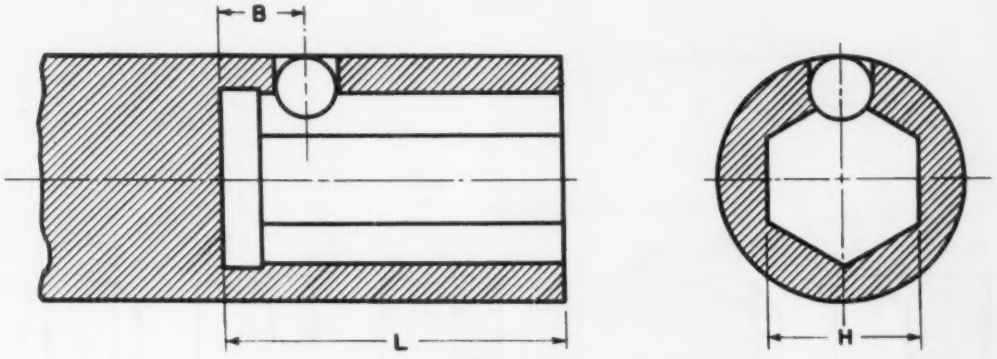
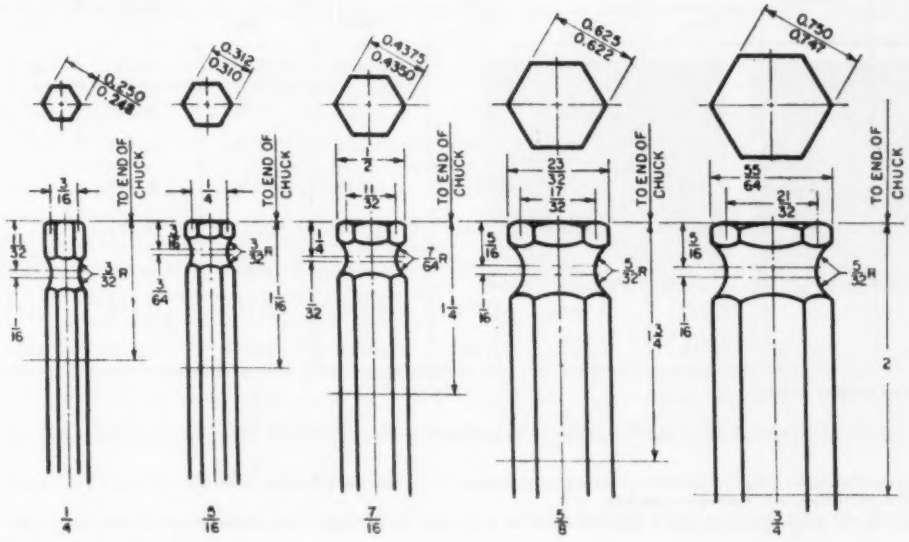


Table 4

Nominal Hexagon	H		B ± 0.005	L Max.
	Min.	Max.		
1/4	0.253	0.255	3/8	15/16
5/16	0.314	0.316	13/64	1
7/16	0.442	0.444	17/64	1 1/8
5/8	0.630	0.632	11/32	1 5/8
3/4	0.755	0.758	11/32	1 7/8

2. Hexagonal Shanks



All dimensions given in inches.

Extracted from American Standard Driving and Spindle Ends for Portable Air and Electric Tools (ASA B5.38-1958), with permission of publisher, the American Society of Mechanical Engineers, 29 W. 39th St., New York 18, N. Y.

AMERICAN STANDARD DRIVING AND SPINDLE ENDS FOR PORTABLE AIR AND ELECTRIC TOOLS—4

(Percussion Tools Excluded)

Approved as American Standard October 29, 1958

III. Threaded Fastener Drives (Cont'd.)

3. Square Drives - Female

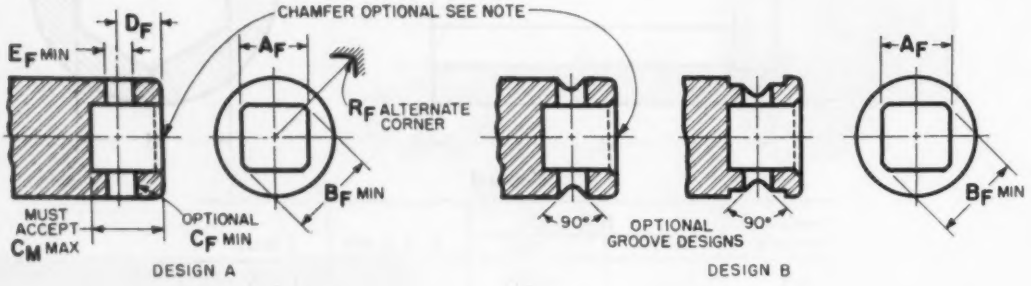


Table 5

Drive Size	Design	Female End						
		A_F		B_F	D_F		E_F	R_F
		Max.	Min.	Min.	Max.	Min.	Min.	Max.
Inch		Inch	Inch	Inch	Inch	Inch	Inch	Inch
1/4	A	0.258	0.253	0.335	0.159	0.147	0.090	....
3/8	A	0.383	0.378	0.505	0.221	0.209	0.170	....
1/2	A	0.508	0.503	0.670	0.315	0.303	0.201	....
5/8	A	0.633	0.628	0.839	0.315	0.303	0.201	....
3/4	B	0.758	0.753	1.005	0.409	0.397	0.216	0.047
1	B	1.009	1.004	1.350	0.596	0.584	0.234	0.062
1 1/2	B	1.510	1.505	1.983	0.647	0.635	0.310	0.125

All dimensions given in inches.

C_F minimum for both designs A and B should be equal to C_M maximum as shown in Table 6, which is to be published in a later data sheet.

Incorporating fillet radius (R_M) at shoulder of male tang precludes use of minimum diameter cross-hole in socket (E_F) unless female drive end is chamfered (shown as optional).

If female drive end is not chamfered, socket cross-hole diameter (E_F) shall be increased to compensate for fillet radius R_M (max.).

Extracted from American Standard Driving and Spindle Ends for Portable Air and Electric Tools (ASA B5.38-1958), with permission of publisher, the American Society of Mechanical Engineers, 29 W. 39th St., New York 18, N. Y.

MEET MRS. PETER PEFF

...and her company's new lightweight liquid-oxygen "vacuum bottle" for jet planes

Mrs. Peff, president, Superior Air Products, Newark, N. J., with Supairco's recently developed liquid-oxygen "vacuum bottle."

MANY a tough problem has been solved by Mrs. Peff and her company since 1952, when she assumed the presidency after her husband's death. Specialists in building low-temperature apparatus and complete plants to produce oxygen and other gases, "Supairco" was asked recently to develop a light, compact container to supply oxygen for aircraft crews at high altitudes.

Ingenious design utilizing the broad and varied properties available in copper and its alloys produced the "vacuum bottle" shown above. The inner sphere is of Everdur®, Anaconda copper-silicon alloy, which has the workability and resistance to corrosion needed —and, more important, the strength and toughness to make possible a relatively thin, light shell that can withstand vibration and fatigue stresses aloft—plus shocks from catapult launchings and carrier landings. The outer shell is of Anaconda copper, highly polished to reflect heat. This, plus a vacuum under .001 microns between the spheres, holds liquid oxygen at −297 F.

Starting with over 100 standard copper alloys, Anaconda can provide an almost unlimited number of combinations of useful properties. When new and unusual problems arise, use Anaconda technical specialists to help you select metals for your needs. Address the American Brass Company, Waterbury 20, Conn. In Canada: Anaconda American Brass Ltd., New Toronto, Ont. 5040

LEFT: Inside the copper shell in main illustration is this slightly smaller liquid-oxygen container made of Everdur, the metal that spins and machines readily, is easy to join by soldering, brazing, welding. **RIGHT:** Completed liquid-oxygen converter, built by Mine Safety Appliances Company, Pittsburgh, Pa., serves 8-man crew. It is one-third the weight of the cylinder it replaces, takes much less space.

ANACONDA®

COPPER • BRASS • BRONZE
NICKEL SILVER MILL PRODUCTS
Made by The American Brass Company

For more data, circle this page number on inquiry card

Co., Inc., Greenfield, Mass., as representative for the company line in the Massachusetts area.

R. H. MEZGER was appointed district manager, industrial sales office, VICKERS INCORPORATED, Worcester, Mass.

Kenneth A. Henn, newly elected domestic sales manager, Jones & Lamson Machine Co.

JONES & LAMSON MACHINE CO., Springfield, Vt., announces that KENNETH A. HENN assumed the newly created position of domestic sales manager. His headquarters will be at the home office in Springfield. He will direct the activities of all district offices, and all domestic Canadian agents. Mr. Henn, formerly manager of the Jones & Lamson Detroit office, will be succeeded in that post by LEWIS BERNARDINI.

Georgia, Maryland, and Virginia

HERMAN DYKEMA of the MACHINE TOOL DIVISION of Kalamazoo Tank and Silo Co., Kalamazoo, Mich., has been promoted to district sales manager for seven southeastern states to include Alabama, Florida, Georgia, Tennessee, North and South Carolina, and Virginia. Mr. Dykema will reside in Atlanta after June 15.

BLACK & DECKER MFG. CO., Towson, Md., announced today the formation of a subsidiary, MASTER POWER CORPORATION, that has acquired the operations of the Master Pneumatic Tool Co., Inc., Bedford, Ohio, and Master Pneumatic Tools (Canada), Ltd., Toronto, Ont., Canada.

MILLAN C. SHEVCHIK has been appointed plant superintendent of the new DISSTON DIVISION, H. K. Porter Co., Inc., plant presently under construction in Danville, Va.

Illinois and Indiana

SUNDSTRAND MACHINE TOOL CO., Rockford, Ill., officially changed its name to SUNDSTRAND CORPORATION at the company's annual meeting on April 28. The company also announces that LOUIS H. SCHUETTE has been named administrative vice-president for all operations of Sundstrand and A. H. SWENSON has been elevated from manager to vice-president of the company's hydraulic division. Mr. Schuette was vice-president for the company's aviation, turbo, and hydraulic operations before assuming his broadened administrative duties. Mr. Swenson joined the Sundstrand engineering department in 1935 and served in numerous positions of responsibility before his promotion to vice-president.

CLEARING DIVISION of U. S. Industries, Inc., Chicago, Ill., has appointed JOHN LIU associate director of research and development. VINCENT J. MANKOWSKI has been appointed assistant director of research and development. ROLAND L. GUERIN, JR., has been appointed sales manager of Clearing's newly formed Aircraft & Missiles Division. Mr. Guerin will work out of the company's recently established engineering office in Los Angeles, Calif.

UNIMET CARBIDES, a division of United-Greenfield Corporation, Chicago, Ill., has appointed the following five distributors. They are: INDUSTRIAL EQUIPMENT & SUPPLY CO., 211 W. Main St., Benton Harbor, Mich.; M. D. JOHNSON CO., 464 E. Fourth St., Los Angeles, Calif.; KELDON CO., 1010 Three Mile Road, N. E., Grand Rapids, Mich.; WRIGHT INDUSTRIAL SUPPLY CO., 4837 N. Detroit Ave., Toledo, Ohio; YORDY INDUSTRIAL SUPPLY CO., 200-27th St., Sacramento, Calif.

AMERICAN STEEL FOUNDRIES, Chicago, Ill., and the SOUTH BEND LATHE WORKS, South Bend, Ind., announced that the directors of the two companies have agreed on terms for American Steel Foundries' purchase of the entire assets and business of South Bend Lathe Works. The proposal is subject to approval of stockholders of South Bend at a special meeting on June 9.

WALTER M. HANNEMAN, executive engineer of the SHAKEPROOF DIVISION of Illinois Tool Works, Elgin, Ill., has been appointed by the American Standards Association to represent the Association and United States industry at the approaching conference of the International Standards Organization which will be held in Paris, France, June 9-11, 1959.

ROCKFORD MACHINE TOOL CO., Rockford, Ill., announces the acquisition of MAPLEWOOD MACHINERY CO., Chicago, Ill., and the INGELS ELBOW MACHINE CORPORATION, Chicago, Ill. All manufacturing activities will be moved to Rockford, Ill., and operated as the Maplewood Division of the Rockford Machine Tool Co.

SCULLY-JONES & CO., Chicago, Ill., announces the purchase of all tooling, drawings, and existing inventories for the self-opening stud setters formerly made by JONES & LAMSON MACHINE CO.

BESLY-WELLES CORPORATION, South Beloit, Ill., announces the opening of a new combination branch office and warehouse at 3224 Union Pacific Ave., Los Angeles, Cal.

BEATTY MACHINE & MFG. CO., Hammond, Ind., has purchased the Quickwork line of machine tools from the WHITING CORPORATION, Harvey, Ill. JOHN MCGLONE, sales manager of the Quickwork Division at Whiting Corporation, has joined Beatty in a similar capacity with the new Beatty-Quickwork Division.

Iowa, Michigan, and Missouri

VANADIUM CORPORATION OF AMERICA, New York City, announces its merger with KEOKUK ELECTRO-METALS CO., Keokuk, Iowa. The business and production of Keokuk Electro-Metals Co. will be continued as a division of Vanadium Corporation of America, and the products will be distributed under the present trade name.

VICKERS INCORPORATED, Detroit, Mich., announces the following changes in personnel and organization. OWEN C. DAVIS has been elected vice-president and treasurer. Also, a corporate Market Research Department has been established, with MILTON SHAPIRO as manager. He will report to F. T. HARRINGTON, vice-president, sales.

WALTER R. EBLING has been appointed market and product analyst, the METALLURGICAL PRODUCTS DEPARTMENT of General Electric Co., Detroit, Mich., announced.

DANE SMITH has been appointed district manager at St. Louis, Mo., for VICKERS INCORPORATED.

New York and New Jersey

TRUARC RETAINING RINGS DIVISION of Waldes Kohinoor, Inc., Long Island City, N. Y., announces changes in its sales organization. MEL S. NIELSEN has been appointed Western Division manager. He will make his headquarters at the Waldes Kohinoor branch office at 423-27 E. 12th St., Los Angeles. In addition to having over-all responsibility for the western territory, Mr. Nielsen will serve as Truarc sales engineer in southern California, Arizona, New Mexico, and parts of Nevada, succeeding LUDWIG L. BLUTH, who has retired. PAUL W. VAPNEK has been named to succeed Mr. Nielsen as sales engineer in northern California, Washington, and Oregon. He will make his headquarters at 2270 North Point in San Francisco. PAUL E. WOLFE & ASSOCIATES, fastener specialists with offices at 460 Ridge View Road in Orange, Conn., have been appointed to represent the Truarc division in northern New England. WILLIAM W. CURTIS has been appointed sales engineer for southern New Jersey, eastern Pennsylvania, the eastern part of West Virginia, the District of Columbia, and the states of Delaware, Maryland, and Virginia. He will work out of the branch office at 401 N. Broad St., Philadelphia.

Mr. Curtis succeeds HOWARD ROBERTS, who has rejoined the company's headquarters sales staff in Long Island City. J. O. KING, INC., fastener specialists with headquarters at 1004 Hemphill Ave., N. W., Atlanta, Ga., have been appointed Truarc representatives for the states of Alabama, Georgia, Florida, Mississippi, North and South Carolina, and Tennessee. ROBERT SHELDON will also service the company's accounts in the area. WILLIAM PETERSON has joined the staff of E. E. REMPFER & ASSOCIATES, Truarc representatives in Minneapolis, Minn., and Davenport, Iowa. Mr. Peterson will represent the company throughout the state of Iowa, working out of the Rempfer office at 611 Kahl Building in Davenport. JOHN O'SHAUGHNESSEY, Truarc and QAF representative in Michigan and parts of Ohio, has moved to new quarters at 18954 James Couzens, Detroit.

VAN NORMAN INDUSTRIES, INC., New York City, announced that it has acquired working control of the

M. E. Dupre, vice-president, public relations, Van Norman Industries, Inc.

AMERICAN PULLEY CO. in which it has held a minority interest for the last three years. CHARLES F. MYERS, Van Norman president, is newly elected president of the American Pulley Co. The latter will be continued as a separate company and no further changes in executive or other personnel are contemplated. The appointment of M. E. DUPRE to vice-president, public relations, was also announced by the company. Mr. Dupre will direct advertising, publicity, promotions, trade shows, and public relations for the corporation's various divisions throughout the country.

FRANK COOLBAUGH has been appointed president of the CLIMAX MOLYBDENUM CO., division of American Metal Climax, Inc., New York City. He succeeds WESTON THOMAS, who was elected executive vice-president of the parent organization. Mr. Coolbaugh has advanced steadily in the organization to his present post. He will make his headquarters at the company's executive offices in New York, N. Y.

AIR REDUCTION CO., INC., New York City, announces that E. R. HUMANN, president of Airco Company International, the export division of Air Reduction Co., Inc., is appointed director of purchases of the parent organization. J. G. BELL succeeds Mr. Humann as president of that division.

B. C. AMES CO., Waltham, Mass., announces the appointment of HUB CITY FACTORY AND MILL SUPPLY CO., Oswego Road, Liverpool, N. Y., as its exclusive distributor in the upper eastern New York State area. Among the major cities included in the territory are Utica, Ithaca, Binghamton, Rome, Schenectady, and Watertown.

H & C TOOL SUPPLY CORPORATION, 1239 University Ave., Rochester, N. Y., has been appointed an industrial cutting tool representative of SUPER TOOL CO., Detroit division of Van Norman Industries.

MANHATTAN RUBBER DIVISION, Raybestos-Manhattan, Inc., Passaic, N. J., announces that L. S. HILTON has been appointed manager of the Abrasive and Diamond Wheel Departments of the MANHATTAN RUBBER DIVISION of Raybestos-Manhattan, Inc., Passaic, N. J. He succeeds J. A. LANGE who requested to be relieved of managerial responsibilities in order to devote himself to improving methods and quality. C. FLEMING, JR., has been appointed production and development manager.

New sales executive appointments to succeed him are S. R. DELANEY, sales manager, and A. J. VERRINDER, assistant sales manager, both having had years of field sales experience. Technical superintendents also appointed are D. B. BELL and L. A. BENSON. T. GORDON, formerly superintendent of Diamond Wheel Department, has been appointed field engineer for diamond wheel sales to replace H. AHLERS, who is retiring.

Ohio

GILBERT HARRELL has been promoted by PARKER-KALON DIVISION, General American Transportation Corporation, Clifton, N. J., from field sales engineer to regional sales manager. He will make his headquarters in Cleveland, Ohio, and his operations will cover the North Central States, including upstate New York.

MYRON KOYLE has been named administrative assistant to Herbert E. Markley, vice-president in charge of foreign operations for the TIMKEN ROLLER BEARING CO., Canton, Ohio. Mr. Koyle joined the Management Training Program in 1956 after other activities in the company.

RELIANCE DIVISION, Eaton Mfg. Co., Massillon, Ohio, announces the appointment of WILLIAM R. CHANDLER as manager of its Detroit office at 18451 James Couzens Highway, to succeed L. E. BROWN, who is retiring after thirty-one years with the firm.

W. G. JENKS MACHINERY CO., located at 12417 Cedar Road, Cleveland Heights, Ohio, has been ap-

pointed distributor in the Cleveland area for the CINCINNATI GILBERT MACHINE TOOL CO.

WILLIAM O. ANSHUTZ has been appointed manager of the Gear Division of GREAVES MACHINE TOOL CO., Cincinnati, Ohio.

Pennsylvania

ALUMINUM COMPANY OF AMERICA, Pittsburgh, Pa., announces that FRANK L. MAGEE, president, has been named chief executive officer of the company. Named to serve as executive vice-presidents were M. M. ANDERSON, LEON E. HICKMAN, and LAWRENCE L. LITCHFIELD, JR. Elected to the post of vice-president were THEODORE W. BOSSERT and ROBERT A. LEANARD.

VANADIUM-ALLOYS STEEL CO., Latrobe, Pa., has announced the appointment of ARTHUR LAWLER, JR., and JOHN W. SMELTZ to sales posts in New York City and Buffalo. Mr. Lawler will sell and service the company's tool and special steel products in southern Connecticut, with his headquarters in the New York district office at 270 Madison Ave. Mr. Smeltz will work from the Buffalo district office, calling on accounts in southwestern New York and northeastern Pennsylvania.

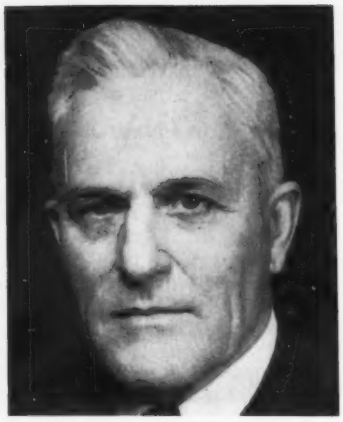
CARPENTER STEEL CO.'s Alloy Tube Division, Pittsburgh, Pa., is moving its mid-eastern regional office, now located at the Airport Bldg., to a new location at Parkway Office Center, 875 Greentree Road, Pittsburgh 20, Pa. HARRY HAUSER is mid-eastern regional sales manager.

FIRTH-STERLING, INC., Pittsburgh, Pa., announces that JOHN C. REDMOND will assume the post of director of research at Firth-Sterling on June 1. He succeeds DAVID F. DICKEY, who is resigning.

JOSEPH T. RYERSON & SON, INC., Philadelphia, Pa., announced the appointments of CLIVE C. EARLE as sales manager and ROBERT H. MARTA as manager of the general order department at the Philadelphia plant. Mr. Earle has been with the company since 1944, and has served in diverse capacities.

Wisconsin

GISHOLT MACHINE CO., Madison, Wis., announces that FRED L. CHAPMAN, after thirty years of service to the company, retired in April. At the time of his retirement, he was vice-president in charge of sales and a member of the board of directors, having been elected to both positions in 1955. HARVEY A. WADDELL was elected secretary and made a member of the board of directors. Mr. Waddell came to the company thirty-two years ago and progressed into the main office where he held various supervisory positions before being elected treasurer.



(Left) Harvey A. Waddell, secretary, and (right) Fred L. Chapman, retiring vice-president—sales, Gisholt Machine Co.

ROBERT A. HEATH has been appointed manager of engineering of Warner Electric Brake & Clutch Co., Beloit, Wis. He will head the Operations Division.

VERNON L. LOOFBORO has been appointed executive vice-president of GARDNER MACHINE CO., Beloit, Wis. He was formerly general manager and previous to that was manager of the Abrasive Division of Gardner.

Vernon L. Loofboro, executive vice-president, Gardner Machine Co.

Canada and Australia

AUGUST SUNNEN has been named to succeed his late father, Gus Sunnen, as general manager of SUNNEN PRODUCTS LTD. in Chatham, Ont.,

August Sunnen, general manager, Sunnen Products Ltd.

Canada. His record includes eight years with the Sunnen St. Louis operation, in which he worked as development engineer, plant superintendent, and general sales manager. Since 1957, he has been a director of Sunnen Products Co., Ltd., Chatham, Ontario, and Sunnen Products Co., St. Louis, Mo.

WALTER JEHU has been named managing director of AUSTRALIAN TIMKEN PROPRIETARY LTD., Ballarat, Australia. Mr. Jehu joined the Timken Co. in 1929 as a sales trainee for the Industrial Division, and after serving in numerous capacities, in 1957 went to Australia as director of sales for Australian Timken.

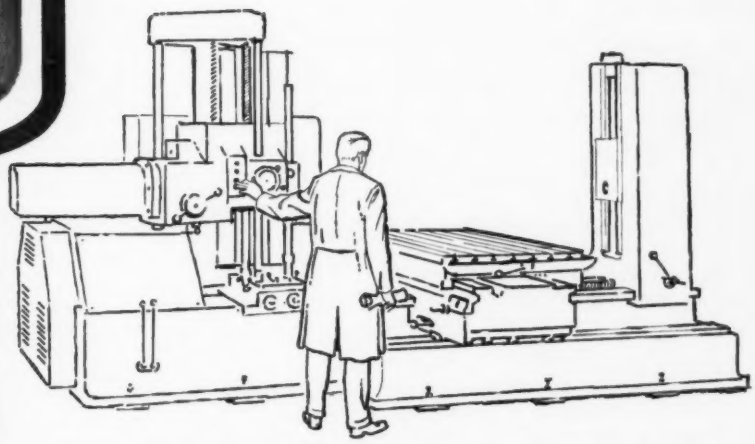
(*This section continued on page 228*)

whatever the **machine tool application . . .** you can depend on **CUNO** engineered filtration

CUNO Filters are vital to the efficient operation of machine tool lubrication, hydraulic, and coolant systems. By removing damaging particles, they help reduce maintenance and replacement costs by protecting bearings, gears, valves, pumps, controls, etc. . . . help improve the quality of the product being manufactured.

Depending upon the specific application, CUNO offers you three basic filter types . . . CUNO Positive Self-Cleaning Edge-Type, CUNO Automatic Self-Cleaning Wire Wound Type, CUNO Disposable Depth Cartridge Filter . . . available in a variety of housings to meet *any* flow requirement.

Whenever *you* have a filtration problem—involving either a built-in application or a centralized system—write us. Our engineers will welcome the opportunity to demonstrate how you can *depend on* CUNO.



THE CUNO ENGINEERING CORP., Dept. 11, MERIDEN, CONN.

A Leader in Industrial Filtration for More Than 30 Years

In Canada: Peacock Bros., Ltd., P. O. Box 1040, Montreal 3, P.Q.

For more data, circle this page number on inquiry card

Europe

MICHEL BISCAYART has been elected president of E. W. BLISS CO., Paris, France. Mr. Biscayart joins Bliss–Paris after thirty years with the

Michel Biscayart, president, E. W. Bliss Co.—Paris

Norton organization, and extensive experience in the metalworking industry.

ALLEGHENY LUDLUM STEEL CORPORATION, Pittsburgh, Pa., announces that one of the nation's most advanced metal-refining furnaces—the electrode vacuum melting furnace—will be produced and sold throughout Europe by the firm of STEIN & ROUBAIX of Paris, France. Negotiations were recently completed between the French firm and Allegheny Ludlum Steel Corporation and the Lectromelt Division of the McGraw-Edison Co.

WARNER & SWASEY CO., Cleveland, Ohio, and ASQUITH MACHINE TOOL CORPORATION, LTD., Halifax, England, are jointly forming a new company to be located in Halifax for the manufacture of the Warner & Swasey line of single-spindle automatics for United Kingdom, European, and other world markets. The new company will be called Warner Swasey Asquith Limited. Sales of these and other Warner & Swasey machine tools in the United Kingdom will be handled by Drummond-Asquith (Sales) Limited, an Asquith subsidiary. Other foreign sales of both English- and American-built Warner & Swasey machines will be handled by Warner & Swasey distributors in the various countries.

E. W. BLISS CO., Canton, Ohio, and HENSCHEL-WERKE, GMBH, of Kassel, West Germany, have completed an agreement for a joint venture in Western Germany. As the first step in this joint operation, Bliss and Henschel have formed a new corporation, Bliss-Henschel, to be located at Dusseldorf.

The MANUFACTURING DIVISION of the Motch & Merryweather Machinery Co., Cleveland, Ohio, has entered into a manufacturing agreement with HELLER BROTHERS of Nuertingen, Germany.

THE CINCINNATI MILLING MACHINE CO. has announced that the management of Cincinnati-Nederland N. V., Vlaardingen, Netherlands, a subsidiary, has been authorized to enlarge its shop and office to provide for additional models of machines to broaden its lines.

Obituaries

HENRY B. AUSTIN, vice-president—sales of Armstrong Bros. Tool Co., Chicago, Ill., died February 26th in Colorado at the age of sixty-one. He joined Armstrong Bros. Tool Co. in 1933 as eastern sales manager. Mr. Austin was made vice-president—sales in 1954.

PAUL A. MONTANUS, president of the Springfield Machine Tool Co., Springfield, Ohio, since 1947, died in that city in April at the age of seventy-six. He joined the company in 1906 as vice-president and general manager and for many years was active in civic affairs.

New Books and Publications

THOMAS' REGISTER OF AMERICAN MANUFACTURERS (1959). 49th Edition. 10,000 pages; 9 by 14 inches. Published by the Thomas Publishing Co., 461 Eighth Ave., New York 1, N. Y. Price, $15 f.o.b. shipping point.

The 49th annual edition of this comprehensive purchasing encyclopedia contains more than 45,000 product-descriptive advertisements. Special changes in this issue should be voted. Information received too late to process in individual product classifications due to closing schedules are included in an addenda section; and the TR code number system is being discontinued. Numbers appearing in this edition should therefore be ignored.

The first three volumes list the names and addresses of manufacturers classified by products. The products are classified not only by generalized group names but by specific types so that the prospective buyer can easily find the particular type that will meet his requirements. The names of the manufacturers under each product classification are arranged by states and cities, thus making it easy for a buyer to select a product within certain geographical boundaries if desired. All classifications are also thoroughly cross-indexed. A capacity or capital investment rating is given for each firm at each product listing.

The fourth volume contains an alphabetical list of manufacturers with branches, subsidiaries, and other data such as company officials and cable codes. It also gives an alphabetical list of trade names, together with export and other miscellaneous information that would be useful to the reader.

Volume five is an index to advertisers and a product-finding guide to the contents.

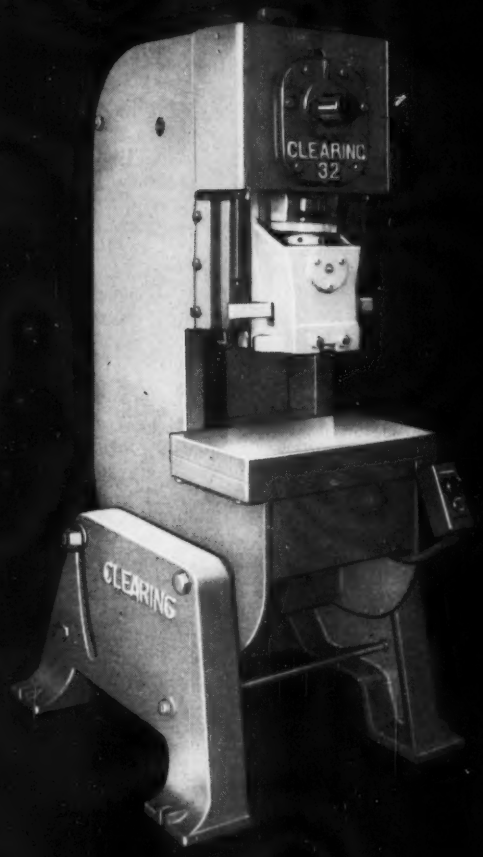
Buyers, engineering research departments, production executives, and all those who require a list of products or names of manufacturers for volume purchasing purposes will find this "where to buy" source an invaluable aid in their work.

GRAPHICAL SYMBOLS FOR FLUID POWER DIAGRAMS. ASA Y32.10-1958. 15 pages; 8 1/2 by 11 inches; illustrated. Published by the American Society of Mechanical Engineers, 29 W. 39th St., New York 18, N. Y. Price, $1.50.

A national standard for graphical symbols to be used on hydraulic and pneumatic circuit diagrams for fluid power systems has become available. Approved by the American Standards Association and published by the ASME, the new American Standard shows basic symbols, describes the principles on which these symbols are based, and illustrates some representative composite results.

Coming Event

SEPT. 28-Oct. 1—American Welding Society Fall Meeting to be held in the Sheraton-Cadillac Hotel, Detroit. AWS headquarters are at 33 W. 39th St., New York 18, N. Y.



GUARANTEED FOR 18 MONTHS

AND WE MEAN UNCONDITIONALLY

That's right. Clearing will guarantee the drive unit of Torc-Pac presses for 18 months. And, as you know, the drive is the heart of the press. The Torc-Pac clutch and brake never require adjustment. The sealed-in-oil drive is designed so that wear which is taken by the friction linings in a conventional air friction clutch, is actually absorbed in the oil.

You just don't have to touch the clutch and brake. In fact, the only thing that could void our guarantee is a condition where the drive has been tampered with by unauthorized personnel.

Torc-Pac presses are available now in capacities of 22, 32, 45 and 60 tons—in high speed ranges, too. Get in touch with Clearing for the full story.

Clearing division of U. S. Industries, Inc. manufactures power presses of all types, Clearing-Axelson and Clearing-Harrison lathes, dies and special tooling, and special equipment for the aircraft and missile industry.

Write for further engineering facts on Clearing's line of Torc-Pac O.B.I.'s.

USI Clearing

DIVISION OF U. S. INDUSTRIES, INC.
6499 W. 65th Street, Chicago 38, Illinois

MACHINERY's New Central Western Representative

Emmet J. O'Connell, who has a wide acquaintanceship in the metalworking industry from years of close association with this industry as an advertising manager and media representative, has been appointed manager of MACHINERY's Central Western territory. His headquarters will be at 228 N. LaSalle St., Chicago 1, Ill. The appointment was effective on May 15.

Emmet J. O'Connell, MACHINERY's new Central Western representative with headquarters in Chicago

Mr. O'Connell has succeeded George H. Buehler, who represented MACHINERY in the territory for approximately thirteen years, and who resigned his connection in order to go into business in Florida. Mr. O'Connell attended the Engineering School of the University of Illinois until the outbreak of World War II. After the close of the war he was with the Verson Allsteel Press Co., Chicago, Ill., for seven years. During his last two years with that concern, he was director of public relations, having previously served as advertising and promotion manager.

For the last three years, Mr. O'Connell was vice-president of Watson Publications, also of Chicago, and publisher of *Metal Forming and Fabricating*, formerly published by that concern.

Mr. Buehler leaves MACHINERY with the best wishes of the entire organization.

• • •

January Data Sheets—Correction

In the data sheet for January, 1959, MACHINERY, page 191, an error appeared in the third sentence of the last paragraph which begins as follows: "For example, 0.020 on a 6.00-inch diameter circle . . ." This should read "For example, 0.010 on a 6.00-inch diameter circle . . ." Also the Greek letter "α" was inaccurately represented by two lowercase letters oc. The correct company affiliation of the author Anderson Duggar, Jr., is Equitable Engineering Co., instead of Equitable Mfg. Engineering Co., as given on pages 191 and 192.

Vanadium-Alloys Expands Facilities

Completion of a three and one-half million dollar plant expansion program has been announced by Vanadium-Alloys Steel Co., Latrobe, Pa. Principal new equipment at the Latrobe plant includes a specially designed, consumable-electrode, vacuum melting furnace, 16-inch and combination 10- and 12-inch rolling mills, and a continuous, controlled-atmosphere, roller-hearth annealing furnace. In addition, a 2000-ton vertical hydraulic forging press, seen in the illustration, has been installed at the company's Colonial Steel Co. Division in Monaca, Pa. All required auxiliary heating and handling equipment has been provided together with new test and inspection facilities. Buildings 97,000 square feet in area have been erected at the two mills to contain the equipment.

The new 2000-ton press, which has a working pressure of 4250 psi, a stroke of 48 inches, and a ram diameter of 35 inches, can forge ingots from 12 inches square, weighing 1 ton, up to those 40 inches square and weighing 10 tons. It can also be used to make die-blocks and disc forgings, and to flatten large bars, plates, and other steel products. Ingots, supplied to the press from automatic furnaces, are placed on the dies by a floor type charging machine and handled by a 10-ton manipulator.

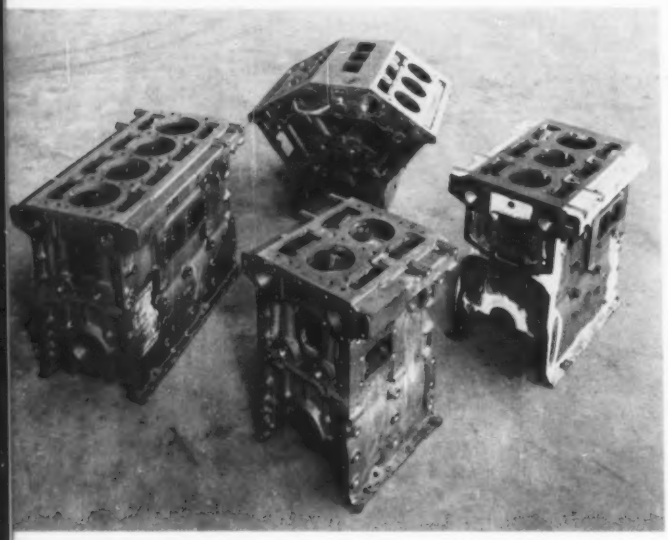
Tomorrow this transfer machine will work on a different part

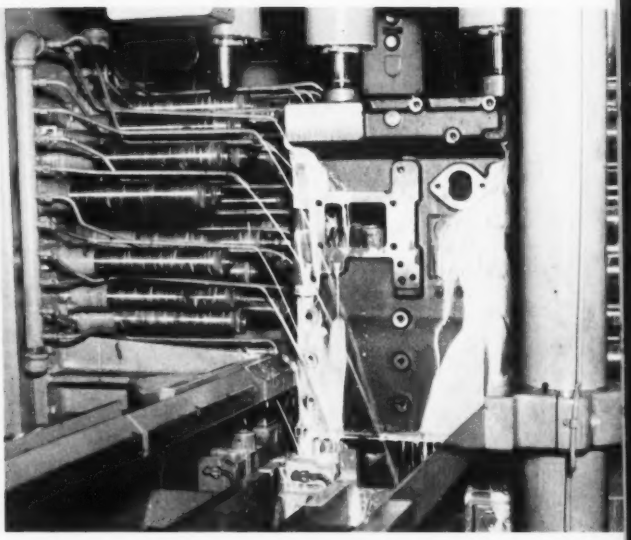
. . . Natco flexible automation can speed your production too.

(see other side)

FOUR PARTS OR ONE CAST IRON OR ALUMINUM

It's all the same to these Natco transfer machines





Look at these four diesel engine blocks. Each is a different machining problem, yet one line of three Natco Holeways does the complete job on them all.

Natco designing skill shows in the easy way these machines accept the four different blocks, either cast iron or aluminum. In only 40 working stations these machines can perform 485 operations. Ingenious transfer devices enable all faces of the workpiece to be machined. Versatile building block construction keeps the line ready for conversion when models change.

Natco Holeway No. 1 is capable of performing 173 different operations—drilling, rough boring, reaming, chamfering and counterboring.

Holeway No. 2 does 139 similar operations, including end milling of these same engine blocks.

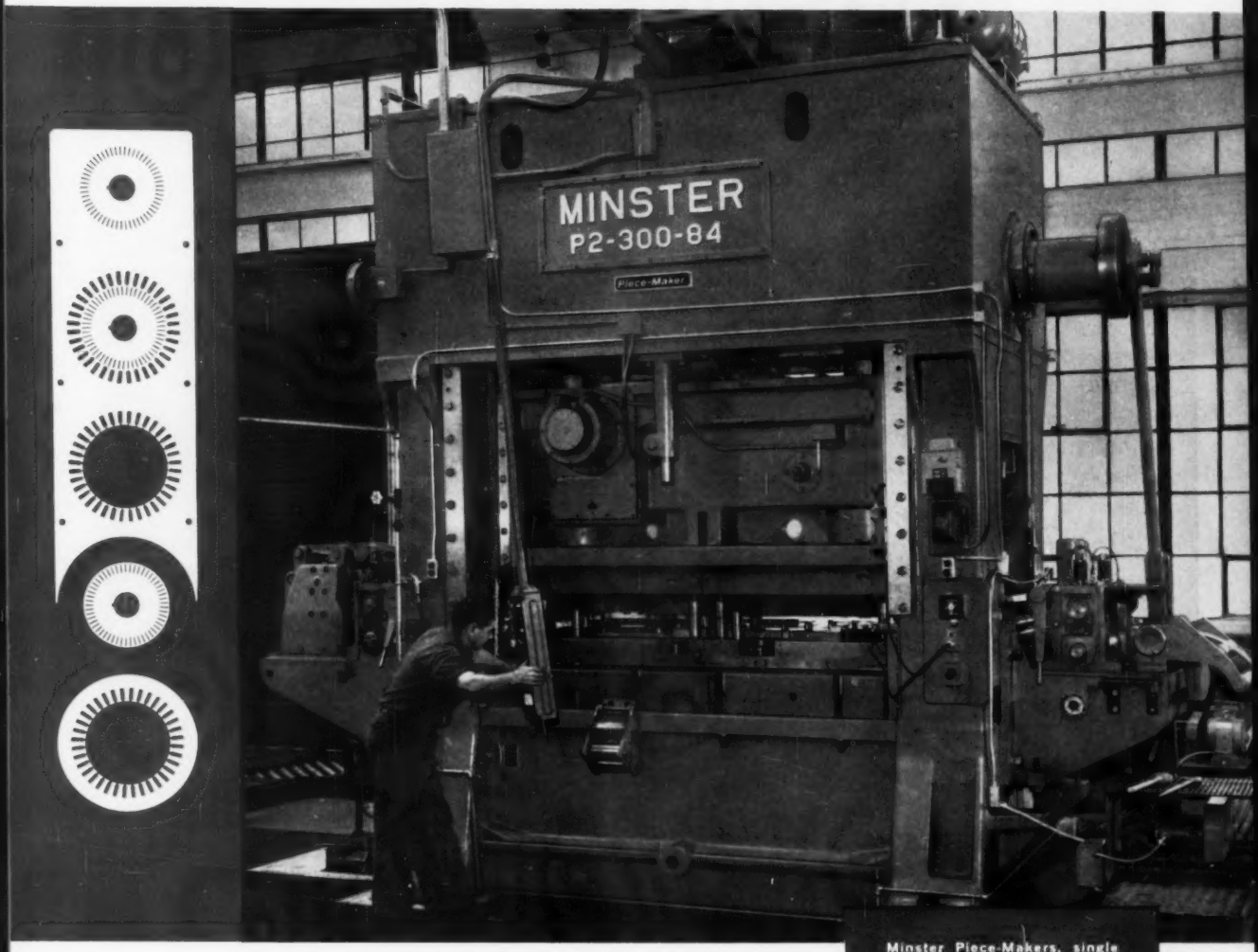
Holeway No. 3 performs 173 tapping operations. These machines work on all the external faces of the blocks, including the angular faces of the V-block.

Product mix problems? Think what a truly flexible Natco like this could do for them! Weigh the value of a Natco which accepts a variety of parts and decides what work to do on them. Even if your production won't justify this ultimate in automatic machining—Natco builds drilling, boring, tapping, facing, reaming, chamfering machines in all degrees of automation.

Standard or special, if your machining job is holes, Natco makes the machine to do it better. Let our representative show you. Call him today.

NATCO NATIONAL AUTOMATIC TOOL COMPANY, INC., RICHMOND, IND.

AUTOMATIC PRODUCTION profits pay for the press



Minster Piece-Makers, single point and two point, have the precision and stability to give uninterrupted performance at the highest possible efficiency. 20 to 300 ton capacity.

Minster *Piece-Maker*® Presses

pay for themselves out of the higher profit per stamping you gain with Automatic Production.

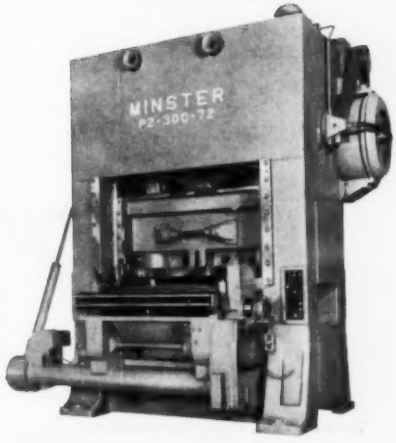
In a Minster Piece-Maker you buy more parts per hour
+ higher production capacity per sq. ft. of space
+ rapid inventory turnover + less handling and storage
+ less waste and damage + longer die and press life

= higher profits that pay for the press

Minster offers a full range of press types and sizes for automatic production. Let us show you, in detail, how a Minster press on *your* job will pay for itself. Write or call

The Minster Machine Company • Minster, Ohio

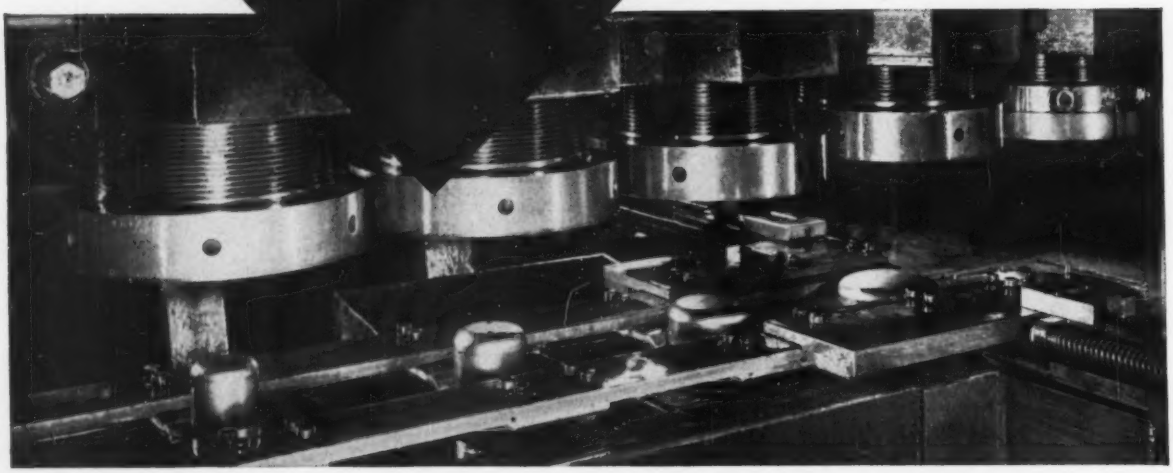
MINSTER®



For more data, circle this page number on inquiry card

MEL-TROL

at work



To deliver uniform performance between grinds, a drawing or blanking die has to be hard and tough through its whole thickness.

And no matter how well it is designed and heat treated, it can only be as uniform through the center as the bar you make it from . . . and the bar can only be as uniform as the ingot from which it is rolled.

That's why, when you make a die from Carpenter MEL-TROL air hardening die steels—such as No. 484 and No. 610 —you *know* you're going to get predictable performance. The high quality of MEL-TROL die steels is guarded by a system of the most advanced and accurate quality controls ever used in steel making.

And an exclusive Carpenter-patented mold produces ingots with greater uniformity through the center than any others made on a production basis today.

Why don't you try Carpenter MEL-TROL quality tool and die steels? Call your Carpenter representative and place your order today.

Carpenter STEEL

The Carpenter Steel Company
Main Office and Mills, Reading, Pa.
Alloy Tube Division, Union, N. J.
Webb Wire Division, New Brunswick, N. J.
Carpenter Steel of New England, Inc., Bridgeport, Conn.

1. Bronze Bearing, with self-adjusting "U" Cup Piston Rod Seal for longer wear.
2. Rod Wiper protects Piston Rod Seal and keeps Cylinder clean.
3. "U" Cup Seals expand with pressure to provide positive seal with minimum friction.
4. Wrench Flats make for easy installation.
5. Ground, hard chrome-plated Piston Rods have minimum yield strength of 125,000 psi.
6. Self-locking cushion adjusting screw and ball check are below surface for protection . . . easily accessible.
7. For extra strength, Cylinder Ends and Mounting Plates are machined from bar stock and steel forgings.
8. Cylinder is precision-finished brass for extra heavy duty.
9. Variety of mountings can be interchanged—easily match any installation requirement.
10. Interchangeable with all JIC Cylinders.

SCHRADER SQUARE-END CYLINDERS

meet and exceed JIC specs . . . 250 psi air . . . 750 psi hydraulic!

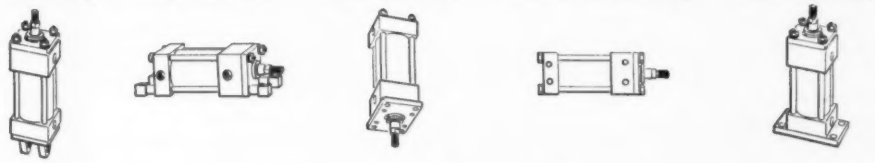
Here's compact, versatile straight-line power. Just look at the features!

Use Schrader's new square-end double-acting cylinders for holding, positioning, moving work—for push, pull or lifting—for automating manual operations. In five sizes up to 4-inch bore, and with five interchangeable mountings, these "square-ends" are economical and versatile. Bolt, leg, flush, side flush or base . . . each JIC Cylinder will mount all five ways. Suitable for air pressures to 250 psi, or hydraulically to 750 psi—available cushioned or non-cushioned.

You get safe, controlled, low-cost power with Schrader "square-ends"—another addition to the line of famous Schrader quality Air Control Products.

Complete stocks available locally—expert help to improve your air control hookups. Write for your complete specifications and data on these new "square-ends."

Bolt Mounting **Leg Mounting** **Flush Mounting** **Side-Flush Mounting** **Base Mounting**



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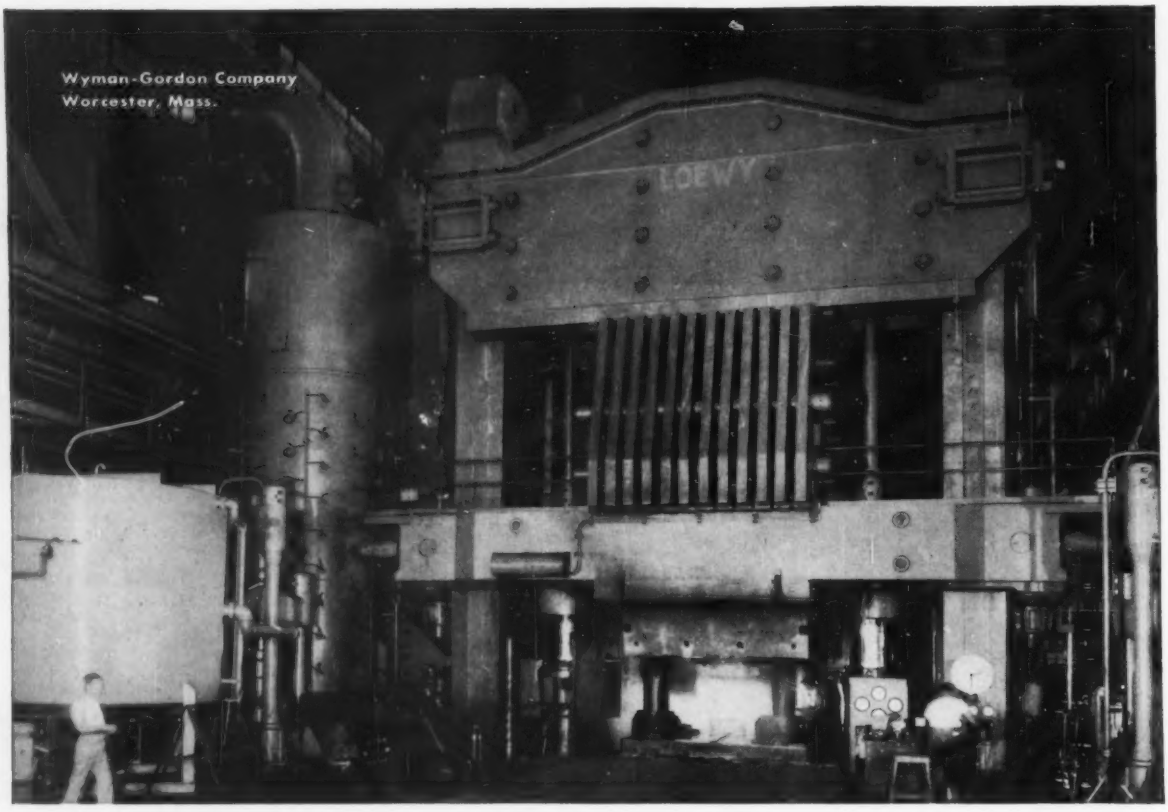
QUALITY AIR CONTROL PRODUCTS

For more data, circle this page number on inquiry card



Operation Big Squeeze:

World's largest presses lubricated by Cities Service Pacemaker Hydraulic Oils

Once a forging operation for horse-drawn carriages, Wyman-Gordon Company now operates the world's largest presses, with the newest one capable of exerting 50,000 tons pressure.

Reason for this tremendous press is the increasing need for strong, lightweight metal parts for aircraft. Today, as for many years, no military or transport aircraft takes to the air without Wyman-Gordon forgings.

With its huge, hydraulically operated presses, Wyman-Gordon is able to forge huge pieces with one big squeeze. Sometimes a whole unit for a landing-gear strut. Or one mammoth wing spar.

The press that exerts 50,000 tons pressure is described by Wyman-Gordon as "the largest single machine ever conceived"—and few people would argue the point after seeing it.

Mounted in a pit that extends nine stories beneath the earth, the giant press is over 114 feet high and weighs 10,605 tons, 6,450 of which moves up and down.

Cities Service is justifiably proud that here as in all of Wyman-Gordon's presses with 18,000 tons pressure or better, hydraulic lubrication is provided by Cities Service Pacemaker Oils.

It is hardly necessary to point out the incredible demands that such machinery makes of its hydraulic lubricants... and certainly it is self-evident that if Cities Service Pacemaker Oils can perform satisfactorily in the world's largest presses, they'll do the same for you. Talk with a nearby Cities Service Lubrication Engineer. Or write: Cities Service Oil Co., Sixty Wall Tower, New York 5, N. Y.

Entire Rig Is Operated by One Man with the few simple controls shown here. With a flick of his fingers he can put on a squeeze of 50,000 tons. Result is extremely strong lightweight forgings for aircraft.

Lubrication Foreman has mammoth responsibility. Here, he checks dispenser for Cities Service EP 20 Lubricant... used on main bed and columns of large presses and other areas subject to extreme pressures.

CITIES SERVICE

QUALITY PETROLEUM PRODUCTS

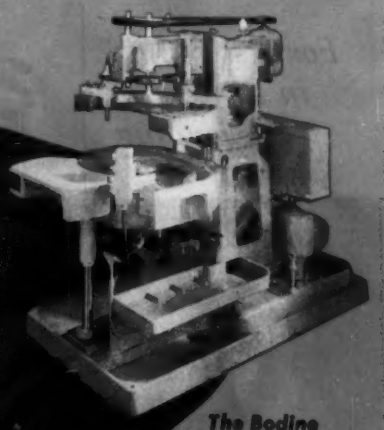
Bodine case history no. 50

whether you figure in

miles · millions · assemblies · tonnage

RUGGED Bodines

have set impressive records



The Bodine Basic Machine

for example:

142 miles

of drilled and tapped holes

The Paine Company is using a Bodine 42-30 to drill and tap anchor inserts (1018 free machining steel). This machine has been in service for 12 years averaging 1500 to 1700 pieces per hour; 1,500,000 per year . . . about 142 miles of drilled and tapped holes.

for example:

36 million

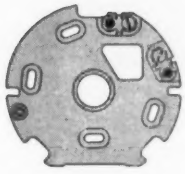
parts in 4 years

United Carr Fastener uses a 48-30 Bodine to tap 5/16-18 holes in 1020 steel dowels. For 4 years this machine has been running at 3600 pieces per hour . . . has produced over 36 million parts.

for example:

9 million

assemblies



Minneapolis-Honeywell uses a Bodine 42-30 for a combination of 10 operations on thermostat wall plates . . . cut off and insert 2 brass terminals — tap (5) #4-40 N.C. holes — insert 2 screws, check and eject. The machine has been running *continuously* for 4 years, completing an average of 35,000 pieces per week . . . close to 9,000,000 assemblies.

for example:

37 tons

of metal removed in 5 years

Elastic Stop Nut Corporation of America uses this Bodine 48-20 to drill, counterbore and tap 10-32 nuts. Five years continuous operation averaging 2500 pieces per hour has produced over 25,000,000 nuts . . . removed an estimated 37 tons of metal in the process.

NO MAJOR OVERHAUL . . .

The Bodine Basic Machines in these case histories have had NO MAJOR OVERHAULS. They are all running day in and day out right now. They are typical of the ENDURANCE, and LONG TROUBLE-FREE service every Bodine owner can expect in machines that are rugged, versatile and capable of multiple tooling and rapid changeover. Send us samples or prints for production analysis . . . without obligation. Write Dept. M-6

THE Bodine CORPORATION

BRIDGEPORT 5, CONNECTICUT

AUTOMATIC DIAL TYPE DRILLING, MILLING, TAPPING, AND SCREW INSERTING MACHINES

28D59

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To make ultrasonic cleaning 100% effective your cleansing agent *must* be right for the job. For example:

One utility was cleaning electric meters ultrasonically. Trouble was too many of the "cleaned" meters still had to be disassembled for hand brushing of hidden parts. Their "clockwork" was emerging only 80% clean—especially those with carbonized soil.

When asked in, the Oakite man made some tests, analyzed the soils, recommended the proper Oakite solution for the job. Results: in 60 seconds, toughest jobs came out of the bath 100% clean, looking like new. As extra bonus, the company saved 75% on material costs.

Ultrasonic cleaning can produce at maximum efficiency when the right cleaning material is used in the bath. What is the right material for you? ASK THE OAKITE MAN. He'll help you pick the one *right* material from a complete line of ultrasonic cleaning compounds especially suited for different conditions . . . composition of soil . . . type of metals to be cleaned. For more data *right now*, write Oakite Products, Inc., 26 Rector Street, New York 6, N. Y.

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FOR RIGHT KIND OF PRODUCTION

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THREADWELL TAP & DIE CO.
GREENFIELD, MASSACHUSETTS

Stocking Warehouses: New York — Cleveland
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For more data, circle this page number on inquiry card

Product Directory

To find headings easily, look for capital letters at top of each page to denote location.

ABRASIVE CLOTH, Paper and Belt
Crane Packing Co., 6400 Oakton St., Morton Grove, Ill.

ABRASIVES, Disc
Gardner Machine Co., Beloit, Wis.
Macklin Co., Jackson, Mich.
Norton Co., 1 New Bond St., Worcester, Mass.
Simonds Abrasive Co., Tacony & Fraley Sts., Philadelphia 35, Penna.

ABRASIVES, Polishing, Tumbling, Etc.
Crane Packing Co., 6400 Oakton St., Morton Grove, Ill.
Macklin Co., Jackson, Mich.
Norton Co., 1 New Bond St., Worcester 6, Mass.
Simonds Abrasive Co., Tacony & Fraley Sts., Philadelphia, 35, Penna.

ACCUMULATORS, Hydraulic
Erie Foundry Co., 1253 W. 12th St., Erie Penna.

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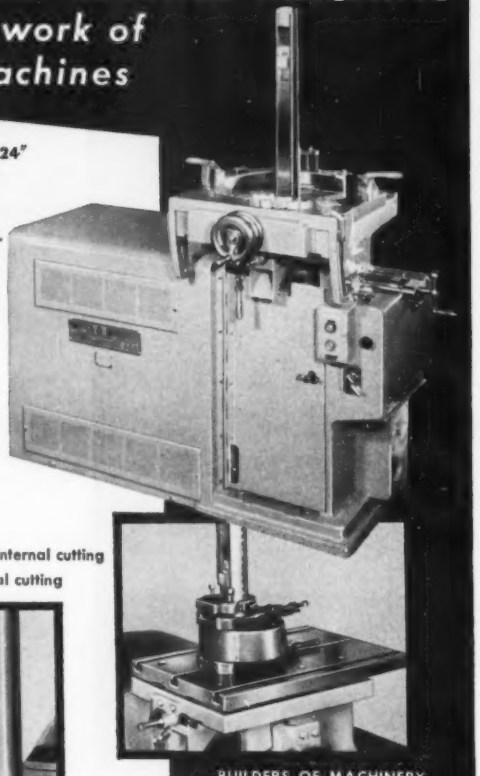
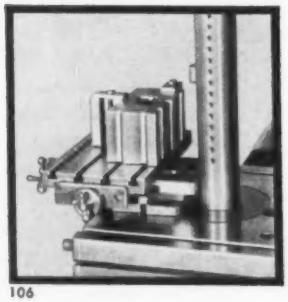
does the work of many machines

In addition to a keyseater that cuts internal keyways up to 3" wide x 24" long, the new hydraulic M & M is a handy tool room machine and can be easily adapted to special production jobs other than keyways. A wide variety of internal or external cuts, serrations, grooves and teeth can be rapidly made on this machine. With a combination tilting table and index table (shown on machine at right) straight or tapered bores and accurately spaced multiple keyways or splines may be cut at any degree of the circle. Send us prints of your cutting problems.



Right: Set-up for internal cutting
Below: Set-up for external cutting



BUILDERS OF MACHINERY SINCE 1854

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AIR GUNS
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Schrader's Sons, A., 470 Vanderbilt Ave., Brooklyn 38, N. Y.

AIR TOOLS—See Grinders, Portable, Pneumatic—Drills, Portable, Pneumatic, Etc.

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Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Jessop Steel Co., Washington, Penna.
Ryerson Joseph T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
U. S. Steel Corp., Carnegie-Illinois Steel Corp. Div., 436 7th Ave. Pittsburgh, Pa.
Vanadium Alloys Steel Co., Latrobe, Pa.
Wheelock, Lovejoy & Co., Inc., Cambridge, Mass.

ALLOYS, Bearing
Bunting Brass & Bronze Co., 715 Spencer, Toledo 1, Ohio.
Carpenter Steel Co., 105 W. Bern St., Reading Penna.
Mueller Brass Co., Port Huron, Mich.

ALUMINUM and Aluminum Products
Revere Copper & Brass, Inc., 230 Park Ave., New York 17, N. Y.
Ryerson & Son, Jos. T., 16th & Rockwell Sts., Chicago 8, Ill.

ANGLE PLATES—See Set-up Equipment

ANNEALING FURNACES
Eisler Engrg. Co., 750 So. 13th St., Newark 3, N. J.

ARBOR PRESSES—See Presses Arbor

ARBORS AND MANDRELS
Brown & Sharpe Mfg. Co., Providence, R. I.
Chicago-Latrobe, 411 W. Ontario St., Chicago 10, Ill. (end mills)
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
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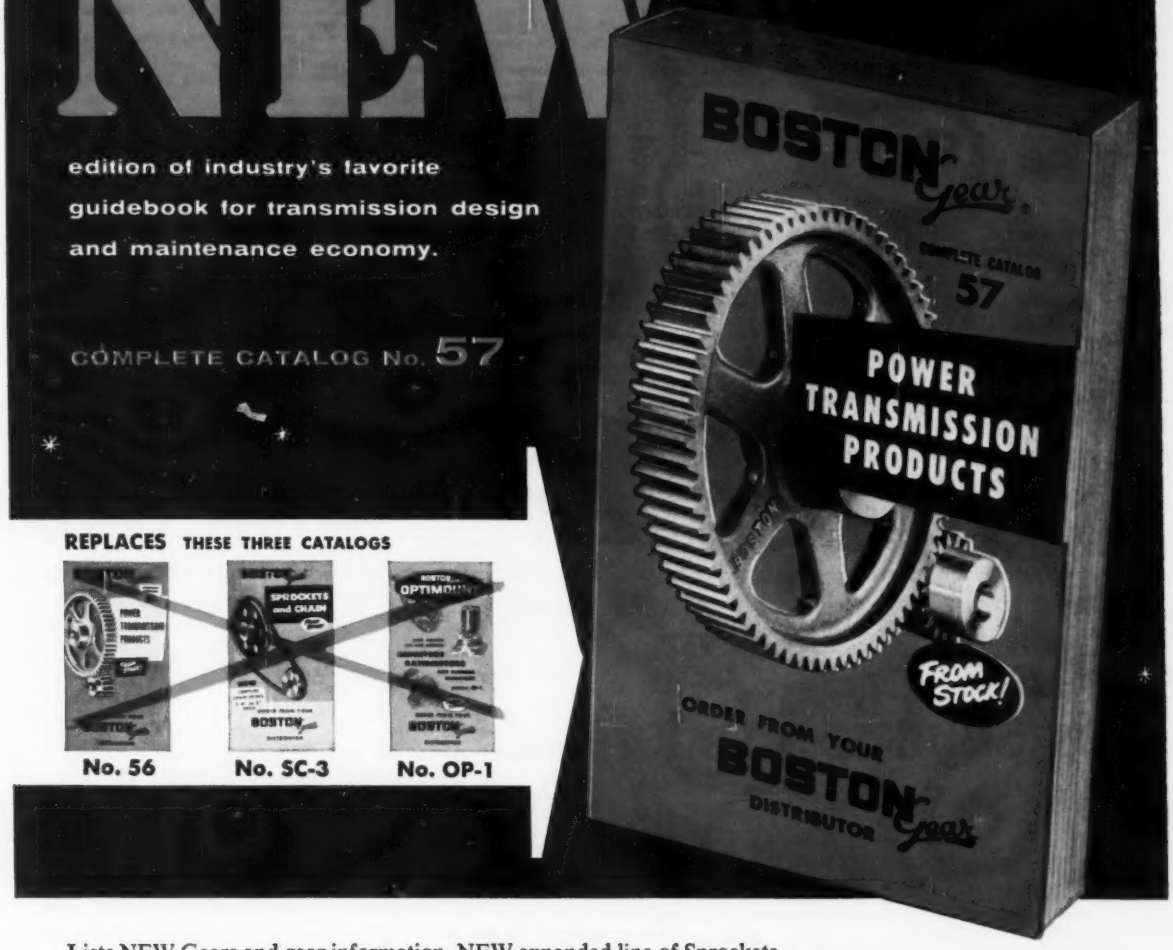

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Sundstrand Mach. Tool Co., 2531 11th St., Rockford, Ill.

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Kennametal, Inc., Latrobe, Penna.

BAR MACHINES—See Screw Machines, Single and Multiple-Spindle, Automatic

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Shenango Furnace Co., Dover, Ohio

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Carpenter Steel Co., 105 W. Bern St., Reading, Penna.
Jessop Steel Co., Washington, Penna.
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BEARINGS, Ball
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Nice Ball Bearing Co., 30th & Hunting Park Ave., Philadelphia, Pa.
Norma-Hoffmann Bearings Corp., Stamford, Conn.
S K F Industries, Inc., Philadelphia, Penna.

BEARINGS, Bronze and Special Alloy
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Bunting Brass & Bronze Co., 715 Spencer, Toledo, Ohio

BEARINGS, Oilless
Bunting Brass & Bronze Co., 715 Spencer, Toledo 1, Ohio
Ryerson, Joseph T. & Son, Inc., 16th & Rockwell Sts., Chicago 8, Ill.

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Bunting Brass & Bronze Co., 715 Spencer, Toledo, Ohio
Fafnir Bearing Co., New Britain, Conn.
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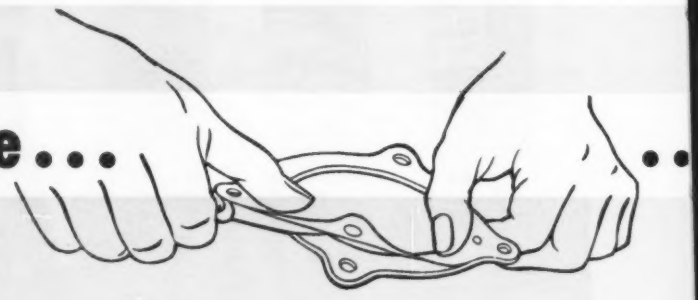

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DeVlieg Microbore Div., 2720 W. Fourteen Mile Road, Royal Oak, Mich.
Heald Machine Co., 10 New Bond St., Worcester 6, Mass.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Mummert-Dixon Co., Hanover, Pa.
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Universal Engineering Co., Frankenmuth 2, Mich.
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Drillmation Co., Inc., Centerline, Mich.
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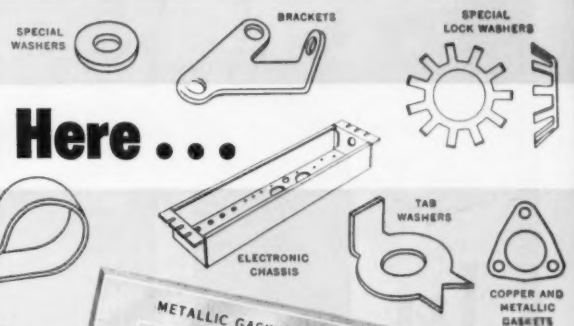

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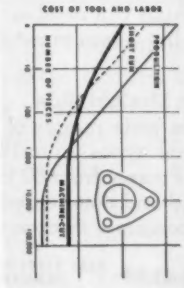

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Jones & Lamson Machine Co., Springfield, Vt.
Kaukauna Machine & Foundry Div., Giddings & Lewis Machine Tool Co., Kaukauna, Wis.
Kearney & Trecker Corp., 6784 W. National, Milwaukee 14, Wis.
Lamb, F. Joseph Co., 5663 E. Nine Mile Rd., Detroit 34, Mich.
Moline Tool Co., Moline, Ill.
National Automatic Tool Co., Inc., S. 7th and N. Sts., Richmond, Ind.
Olivetti Corp. of America, 42-33 Northern Blvd., Long Island City 1, N. Y.
New Britain Mch. Co., New Britain-Gridley Mch. Div., New Britain, Conn.
Olofsson Corp., Lansing, Mich.
Orban Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Sheffield Corp., Box 893 Dayton 1, Ohio
Snyder Corp., 3400 E. Lafayette Ave., Detroit 7, Mich.
Wales-Strippit, Inc., Akron, N. Y.

BORING MILLS, Horizontal
American Schiess Corp., 1232 Penn Ave., Pittsburgh 22, Pa.
Bullard Co., Bridgeport 6, Conn.
Cincinnati Gilbert Machine Tool Co., 3366 Beekman St., Cincinnati 23, Ohio.
Consolidated Mch. Tool Div., 565 Blossom Rd., Rochester 10, N. Y.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
DeVlieg Machine Co., Fair St., Royal Oak, Mich.
Espen-Lucas Machine Works, Front St. and Girard Ave., Philadelphia, Pa.
Gray, G. A., Co., 3611 Woodburn Ave., Cincinnati 7, Ohio.
Lucas Mch. Tool Div., New Britain Mch. Co. 12302 Kirby Ave., Cleveland 8, Ohio.
New Britain Mch. Co., New Britain, Conn.
Snyder Corp., 3400 E. Lafayette Ave., Detroit 7, Mich.

BORING MILLS, Vertical
American Schiess Corp., 1232 Penn Ave., Pittsburgh 22, Pa.
Berthiez, Charles, 5 Rue Montalivet, Paris France
Bullard Co., 286 Canfield Ave., Bridgeport 6, Conn.
Consolidated Mch. Tool Div., 565 Blossom Rd., Rochester 10, N. Y.
Cosa Corp, 405 Lexington Ave., New York 17, N. Y.
Hamilton Div., Baldwin-Lima-Hamilton Corp., Hamilton, Ohio
Kaukauna Machine & Foundry Div., Giddings & Lewis Machine Tool Co., Kaukauna, Wis.
King Machine Tool Div., American Steel Foundries, 1150 Tennessee Ave., Cincinnati 29, Ohio.
New Britain Mch. Co., New Britain, Conn.
Snyder Corp., 3400 E. Lafayette Ave., Detroit 7, Mich.

BORING TOOLS
American Schiess Corp., 1232 Penn Ave., Pittsburgh 22, Pa.
Armstrong Bros. Tool Co., 5213 W. Armstrong Ave., Chicago 46, Ill.
Bullard Co., 286 Canfield Ave., Bridgeport 6, Conn.
Davis Boring Tool Div., Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
DeVlieg Microbore Div., 2720 W. Fourteen Mile Road, Royal Oak, Mich.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Maxwell Industries, Inc., Ashtabula, Ohio
Metallurgical Products Dept. of General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Pratt & Whitney Co., Inc., West Hartford, Conn.
Vascoloy-Ramet Corp., Waukegan, Ill.
Wesson Co., 1220 Woodward Heights Blvd., Detroit 20, Mich.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

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Cincinnati Shaper Co., P. O. Box 111, Cincinnati 11, Ohio.
Cleveland Crane & Engrg. Co., Wickliffe, Ohio.
Ferracute Machine Co., Bridgeport, N. J.
Lodge & Shipley Co., Hamilton 1, Ohio.
Niagara Mch. & Tool Wks., 637 Northland Ave., Buffalo 11, N. Y.
Verson Allsteel Press Co., 93rd St. and S. Kenwood Ave., Chicago, Ill.

BRASS
American Brass Co., 25 Broadway, New York N. Y.
Mueller Brass Co., Port Huron 35, Mich.
Revere Copper & Brass, Inc., 230 Park Ave., New York, N. Y.

BROACHES
du Mont Corp., Greenfield, Mass.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Metallurgical Products Dept. of General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Sundstrand Mch. Tool Co., 2531—11th St., Rockford, Ill.
Threadwell Tap & Die Co., 16 Arch St., Greenfield, Mass.
Wesson Co., 1220 Woodward Heights Blvd., Detroit 20, Mich.

BROACHING MACHINES, Internal
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Sundstrand Mch. Tool Co., 2531—11th St., Rockford, Ill.
Wilson, K. R., Inc., 211 Mill St., Arcade, N. Y.

BROACHING MACHINES, Surface
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Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
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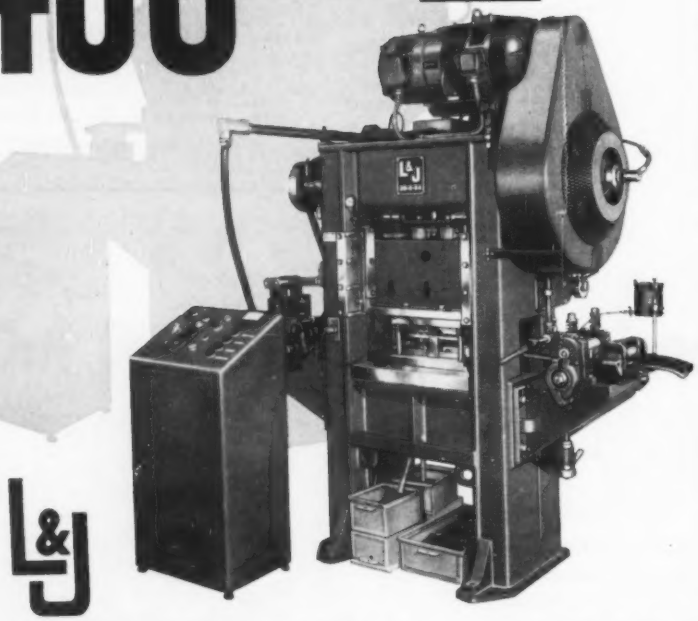
Osborn Mfg. Co., 5401 Hamilton Ave., Cleveland, Ohio.

450 S.P.M. to keep production costs down



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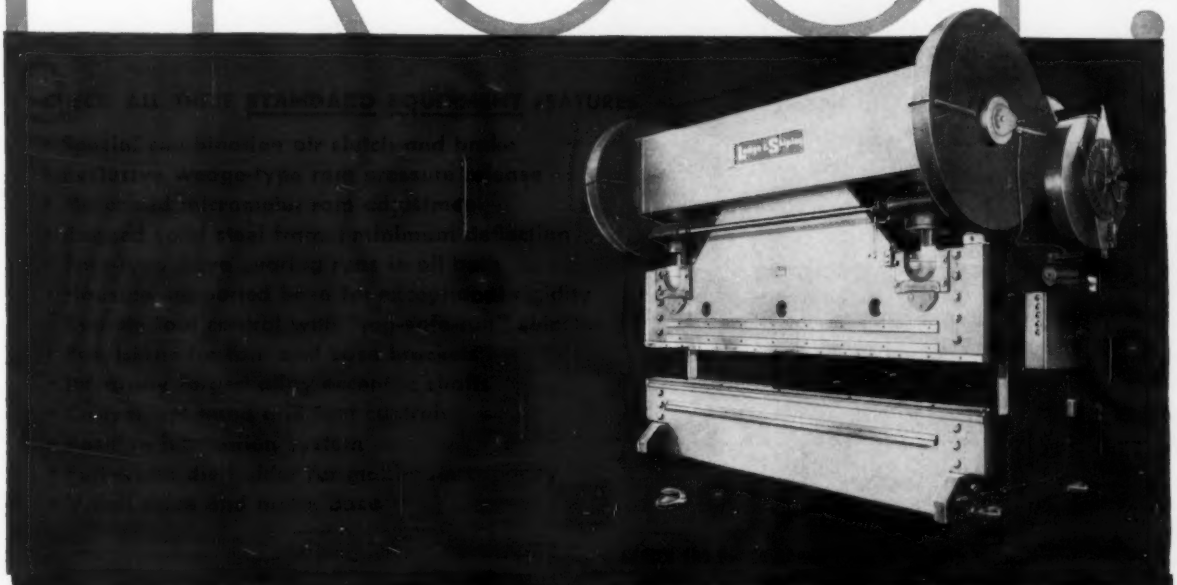

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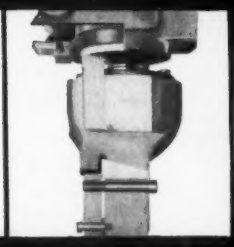
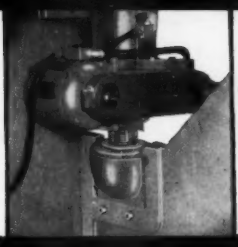
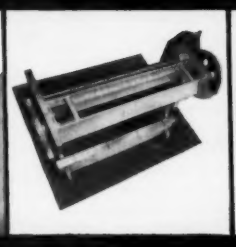


RAM PRESSURE RELEASE . . . exclusive design saves time, dies and machine; operates quickly and easily.



MICRO-RAM ADJUSTMENT . . . push button, direct reading adjustment — includes declutch for adjusting out of parallel.



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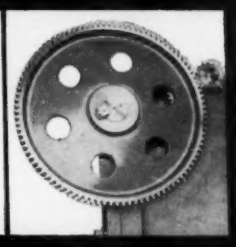

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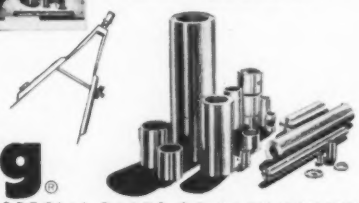

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Lamb, F. Joseph Co., 5663 E. Nine Mile Rd., Detroit 34, Mich.

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BURRS—See Files and Burrs, Rotary

BUSHINGS, Drill Jig
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Metal Corbides Corp., 6001 Southern Blvd., Youngstown 12, Ohio.
Universal Engrg. Co., Frankenmuth, Mich.

BUSHINGS, Hardened Steel
Universal Engrg. Co., Frankenmuth, Mich.

BUSHINGS, Non-ferrous and Powdered Metal
Bunting Brass & Bronze Co., 715 Spencer, Toledo Ohio.
Universal Engrg. Co., Frankenmuth, Mich.

CALIPERS, Spring, Firm-Joint, Transfer, Hermaphrodite, etc.—See Layout and Drafting Tools, Machinists' Small Tools

CALIPERS, Vernier
Brown & Sharpe Mfg. Co., Providence, R. I.
DoAll Co., Des Plaines, Ill.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Starrett, The L. S. Co., Athol, Mass.

CAM CUTTING MACHINES
Cincinnati Milling & Grinding Mchs., Inc., Cincinnati 9, Ohio.
Cosa Corp., 405 Lexington Ave., New York, 17, N. Y.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Pratt & Whitney Co., Inc., West Hartford, Conn.
Van Norman Machine Co., 3640 Main St., Springfield 7, Mass.

CAMERAS, High Speed
Wollensak Optical Co., Rochester 21, N. Y.

CAM MILLING AND GRINDING MACHINES
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Cincinnati Milling Machine Co., Oakley, Cincinnati, Ohio.
Landis Tool Co., Waynesboro, Pa.
Rowbottom Machine Co., Waterbury, Conn.

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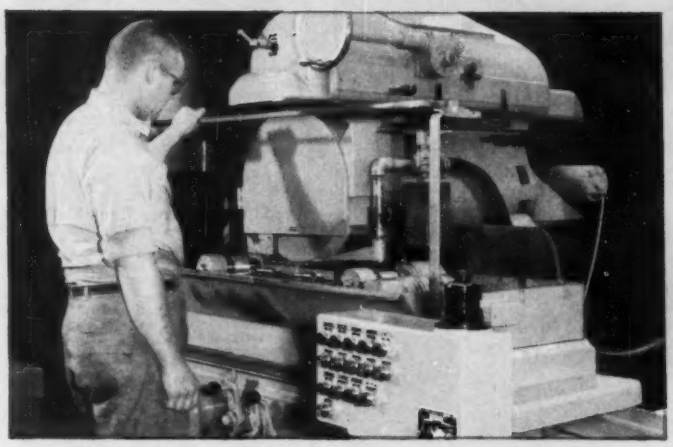
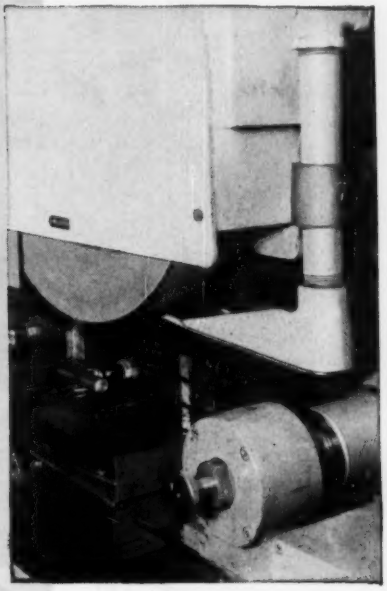




In the production of ledger plates, used in the cutter bar of mowing machines, The Oliver Corp. of Chicago, formerly first milled the teeth, then hardened the plate. The hardening process caused distortion and variance in uniformity which impaired the cutting action of the bar.

On the advice of Thompson engineers, a Type BB Truforming Grinder with a 2½" width grinding wheel was installed to process these ledger plates as a finished grinding operation. The plates are now heat treated first and the teeth are then formed by grinding.

The installation of the Thompson Truforming Grinder has accomplished the following results:

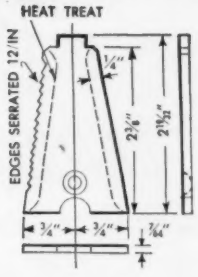
1. **Cut total production costs from $3.18 to $1.06 per 100 pieces.**
2. **Increased the production rate from 1600 to over 3600 pieces per 8-hour shift.**
3. **Provided constant uniformity in the workpieces.**
4. **Eliminated the full-time service of one man.***
5. **A pair of $160.00 milling cutters formerly produced 20,000 pieces. A $60.00 grinding wheel now produces well over 40,000 pieces.**

The leadership of Thompson Truforming Grinders results from 25 years of research and development work in crush form grinding. Today these machines are opening up hundreds of practical, time-saving, profit-improving and cost-cutting applications for industry.

Thompson's engineering experience is available to you without obligation. Write for Catalog T558.

Automatic machine cycle allows operator time to countersink hole in plate—an operation formerly requiring one man's full time.

THE THOMPSON GRINDER CO.
SPRINGFIELD, OHIO



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High Carbon Manganese Steel
Rockwell C52-58

"Keep Thompson in mind for that daily grind"

Thompson SURFACE GRINDERS

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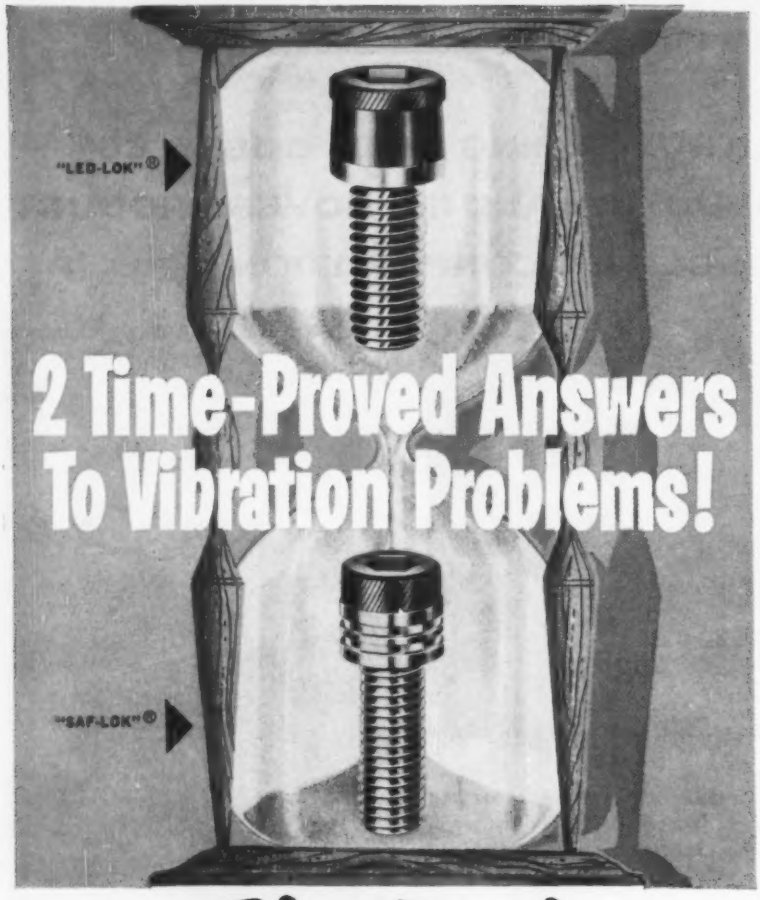

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SOCKET SCREWS

positively will not loosen under any vibration. They're also air-, water-, gas- and oil-tight. Same screw sizes as standard sockets, require no assembly changes.

SAF-LOK®

SOCKET SCREWS

have same exclusive anti-vibration advantages as LED-LOK. Insert is bronze, not affected by heat and absolutely safe for use with all food and chemical equipment.

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Actual cross-section diagram shows how cold forming of Blue Devil Socket head insures unimpaired fiber continuity.

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Kennametal, Inc., Latrobe, Penna.
Linde Co., 30 E. 42nd St., New York 17, N. Y.
Metal Carbides Corp., Youngstown, Ohio.
Metallurgical Products Dept. of General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Vascoloy-Ramet Corp., Waukegan, Ill.
Wesson Co., 1220 Woodward Heights Blvd., Detroit 20, Mich.

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Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
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SPECIAL HIGH-PRECISION DIES are needed to stamp out an intricate mica blank like this, used for positioning electronic tube elements.

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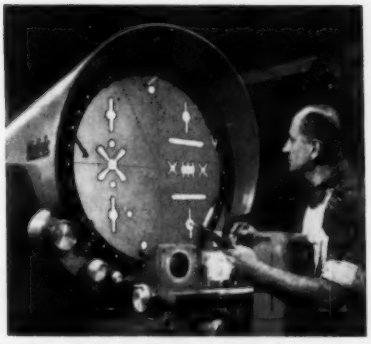
Cut inspection costs . . . Along with accuracy, optical gaging with Kodak Contour Projectors offers you savings in tool costs, increased inspection rates, and the economies that result from a minimum of operator training.



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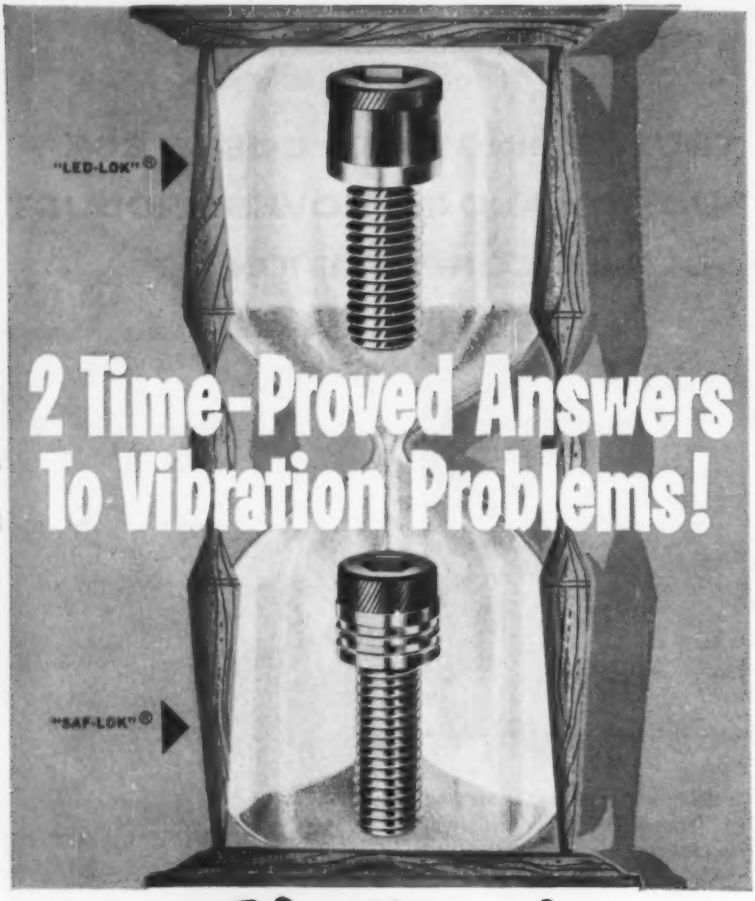

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SOCKET SCREWS

positively will not loosen under any vibration. They're also air-, water-, gas- and oil-tight. Same screw sizes as standard sockets, require no assembly changes.

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SOCKET SCREWS

have same exclusive anti-vibration advantages as LED-LOK. Insert is bronze, not affected by heat and absolutely safe for use with all food and chemical equipment.

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DoALL Co., Des Plaines, Ill.
Kennametal, Inc., Latrobe, Penna.
Linde Co., 30 E. 42nd St., New York 17, N. Y.
Metal Carbides Corp., Youngstown, Ohio.
Metallurgical Products Dept. of General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Vascoloy-Ramet Corp., Waukegan, Ill.
Wesson Co., 1220 Woodward Heights Blvd., Detroit 20, Mich.

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American Brass Co., Waterbury 20, Conn.
Madison-Kipp Corp., Madison, Wis.

CASTINGS, Non-ferrous
Bethlehem Steel Co., 701 East Third St., Bethlehem, Pa.
Mueller Brass Co., Port Huron 35, Mich.
Shenango Furnace Co., Dover, Ohio.
Textile Machine Works, Reading, Penna.
Vascoloy-Ramet Corp., Waukegan, Ill.

CASTINGS—Gray Iron, Malleable
Bethlehem Steel Co., 701 East Third St., Bethlehem, Pa.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.
Kaukauna Machine & Foundry Div., Giddings & Lewis Machine Tool Co., Kaukauna, Wis.
Malleable Castings Council, 1800 Union Commerce Bldg., Cleveland 14, Ohio.
Shenango Furnace Co., Dover, Ohio.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
Textile Machine Works, Reading, Penna.

CASTINGS, Steel, Stainless, etc.
Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Bethlehem Steel Co., 701 East Third St., Bethlehem, Pa.
Birdsboro Steel Fdry. & Mch. Co., Birdsboro, Pa.
Jessop Steel Co., Washington, Penna.

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Baker Brothers Inc., 1000 Post Ave., Toledo 10, Ohio.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

CENTER PUNCHES—See Machinists' Small Tools

CENTERS, Grinding Machines, Indexing Head and Lathe
DoAll Co., Des Plaines, Ill.
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Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.

CERAMIC TOOL MATERIAL—See Tool Material, Ceramic

CHAINS, Power Transmission and Conveyor
Boston Gear Works, 14 Hayward St., Quincy 71, Mass.

CHUCKING MACHINES, Multiple-Spindle Automatic
Bullard Co., 286 Canfield Ave., Bridgeport 6, Conn.
Burg Tool and Mfg. Co., Inc., 15001 S. Figueroa, Gardena, Calif.
Cross Co., P. O. Box 3835, Park Grove Postal Sta., Detroit 5, Mich.
Goss & DeLeeuw Mch. Co., Kensington, Conn.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.
New Britain Mch. Co., New Britain-Gridley Mch. Div., New Britain, Conn.

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require the critical inspection that only the Kodak Contour Projector provides.

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Accuracy, plus . . . With this large-screen (30-inch) comparator you get a projected image that's as *free* from distortion as the science of optics will permit—accuracy on *every* inch of the viewing screen, including the very edges.

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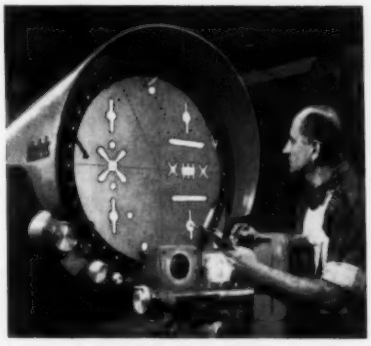
Cut inspection costs . . . Along with accuracy, optical gaging with Kodak Contour Projectors offers you savings in tool costs, increased inspection rates, and the economies that result from a minimum of operator training.



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Kodak

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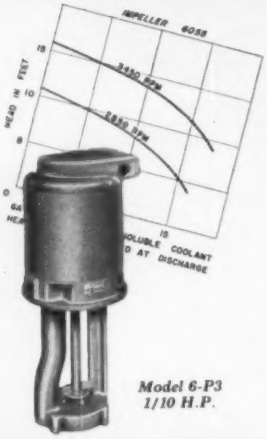
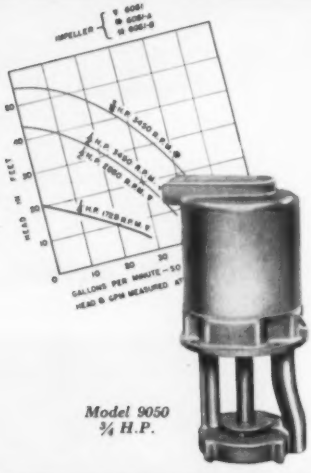


Model 6-P3 1/10 H.P.



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Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 3, Ohio.

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Bullard Co., 286 Canfield Ave., Bridgeport 6, Conn.
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.
Jones & Lamson Mch. Co., Springfield, Vt.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.
Potter & Johnston Co., 1027 Newport Ave., Pawtucket, R. I.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 83, Ohio.

CHUCKS, Air Operated
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.
Logansport Machine Co., Inc., 810 Center Ave., Logansport, Ind.
Schrader's Son, A., 470 Vanderbilt Avenue, Brooklyn, N. Y.
Skinner Chuck Co., 95 Edgewood Ave., New Britain, Conn.

CHUCKS, Collet
Buck Tool Co., 2015 Schippers Lane, Kalamazoo, Mich.
Gisholt Mch. Co., 1245 E. Washington Ave., Madison 10, Wis.
Gorton Mch. Co., Geo., 1321 Racine St., Racine, Wis.
Hardinge Bros., Inc., 1420 College Ave., Elmira, N. Y.
Jacobs Mfg. Co., West Hartford 10, Conn.
Kearney & Trecker Corp., 6784 W. National, Milwaukee 14, Wis.
National Acme Co., 170 E. 131st St., Cleveland 8, Ohio.
New Britain Mch. Co., New Britain-Gridley Mch. Div., New Britain, Conn.
Standard Tool Co., 3950 Chester Ave., Cleveland 14, Ohio.
Universal Engrg. Co., Frankenmuth 2, Mich.
Warner & Swasey, 5701 Carnegie Ave., Cleveland 3, Ohio.
Zagar, Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio.

CHUCKS, Combination Universal-Independent
Buck Tool Co., 2015 Schippers Lane, Kalamazoo, Mich.
Geometric-Horton Div., United Greenfield Corp., New Haven, Conn.
Gisholt Mch. Co., Madison, 10, Wis.
Kearney & Trecker Corp., 6784 W. National, Milwaukee 14, Wis.
L-W Chuck Co., Toledo 4, Ohio
National Acme Co., 170 E. 131st St., Cleveland 8, Ohio.
Skinner Chuck Co., 95 Edgewood Ave., New Britain, Conn.

CHUCKS, Compensating
Buck Tool Co., 2015 Schippers Lane, Kalamazoo, Mich.
Burg Tool and Mfg. Co., Inc., 15001 S. Figueroa, Gardena, Calif.
Logansport Mch. Co., Inc., Logansport, Ind.
Skinner Chuck Co., 95 Edgewood Ave., New Britain, Conn.

CHUCKS, Diaphragm
Woodworth, N. A. Co., 1300 E. Nine Mile Rd., Detroit 20, Mich.

CHUCKS, Drill, Key Type
Jacobs Mfg. Co., West Hartford, Conn.

CHUCKS, Drill, Keyless
Ettco Tool Co., Inc., 594 Johnson Ave., Brooklyn 37 N. Y.
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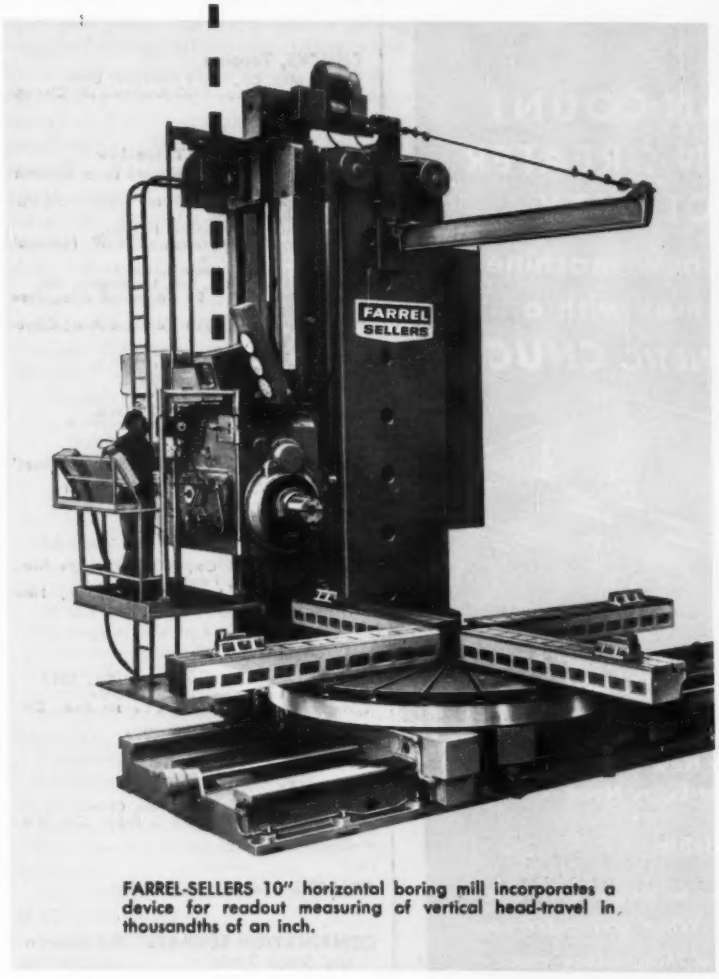

FARREL-SELLERS 10" horizontal boring mill incorporates a device for readout measuring of vertical head-travel in thousandths of an inch.

From a television monitor, mounted on the spindle head, the operator receives a clear picture of the table index band and pointer. Thus, table index position can be seen at a glance.

What's more, the operator can choose from 24 different index bands by raising or lowering the camera (see photo below). A square end shaft, with dial calibrated to correspond to the index bands, automatically focuses on the desired band.

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Television camera, mounted adjacent to the rotating table, relays index band settings to the monitor on the spindle head.

CM-43

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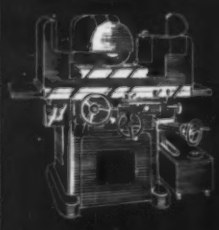
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
Universal Engineering Co., Frankenmuth 2, Mich.

CHUCKS, Gear
Buck Tool Co., 2015 Schippers Lane, Kalamazoo Mich.
Geometric-Horton Div., United Greenfield Corp., New Haven, Conn.
Le Maire Machine Tool Co., 2657 S. Telegraph Rd., Dearborn, Mich.

CHUCKS, Independent
Buck Tool Co., 2015 Schippers Lane, Kalamazoo, Mich.
Geometric-Horton Div., United Greenfield Corp., New Haven, Conn.
Gisholt Mch. Co., Madison 10, Wis.
Skinner Chuck Co., 95 Edgewood Ave., New Britain, Conn.

CHUCKS, etc.
Bullard Co., Brewster St., Bridgeport 2, Conn.
Gisholt Mch. Co., Madison 10, Wis.
Jacobs Mfg. Co., West Hartford, Conn.
Jones & Lamson Mch. Co., Springfield, Vt.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Skinner Chuck Co., 95 Edgewood Ave., New Britain, Conn.
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 3, Ohio.

CHUCKS, Magnetic
Brown & Sharpe Mfg. Co., Providence, R. I.
Hanchett Magna-Lock Corp., Big Rapids, Mich.
L-W Chuck Co., Toledo 4, Ohio.



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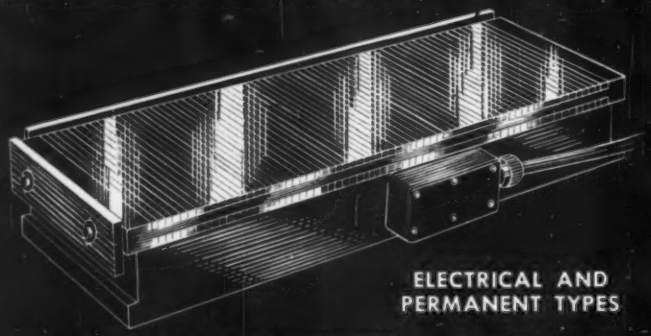

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Skinner Chuck Co., 95 Edgewood Ave., New Britain, Conn.

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Burg Tool and Mfg. Co., Inc., 15001 S. Figueroa, Gardena, Calif.
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Gardner Mch. Co., 414 E. Gardner St., Beloit, Wis.

CHUCKS, Tapping
Jacobs Mfg. Co., West Hartford, Conn.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.

CHUCKS, Universal Three-Jaw
Buck Tool Co., 2015 Schippers Lane, Kalamazoo, Mich.
Geometric-Horton Div., United Greenfield Corp., New Haven, Conn.
Gisholt Mch. Co., Madison 10, Wis.
Kearney & Trecker Corp., 6784 W. National, Milwaukee 14, Wis.
L-W Chuck Co., Toledo 4, Ohio
Logansport Mch. Co., Inc., Logansport, Ind.
Skinner Chuck Co., 95 Edgewood Ave., New Britain, Conn.
Warner & Swasey, 5701 Carnegie Ave., Cleveland 3, Ohio.

CHUCKS, Wrenchless
Gisholt Mch. Co., Madison 10, Wis.

CLAMPS, "C", Toggle, Toolmakers' Parallel—See Set-Up Equipment

CLEANERS, Metal
Houghton, E. F. & Co., 303 W. Lehigh Ave., Philadelphia 33, Penna.
Oakite Products, Inc., 26 Rector St., New York, N. Y.

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Cleveland Punch & Shear Works Co., 3817 St. Clair Ave., Cleveland 14, Ohio.
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Minster Mch. Co., Minster, Ohio.

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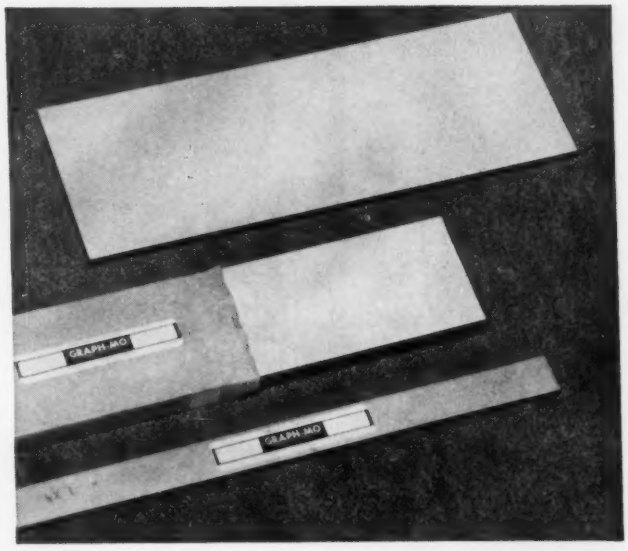

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Kearney & Trecker Corp., 6784 W. National, Milwaukee 14, Wis.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.
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DoALL Co., Des Plaines, Ill.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Mohawk Tools, Inc., Montpelier, Ohio.
Threadwell Tap & Die Co., 16 Arch St., Greenfield, Mass.
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Boston Gear Works, 14 Hayward St., Quincy 71, Mass.
James, D. O., Gear Mfg. Co., 1140 W. Monroe St., Chicago 7, Ill.
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Schrader's Sons, A., 470 Vanderbilt Ave., Brooklyn 38, N. Y.
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Metallurgical Products Dept. of General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Motch & Merryweather Mchy. Co., 888 E. 70th St., Cleveland 3, Ohio.
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Texaco, Inc., 135 E. 42nd St. New York 17, N. Y.

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Brown & Sharpe Mfg. Co., Providence, R. I.
Modern Machine Tool Co., Jackson, Mich.

CUTTING-OFF SAWS, Abrasive Wheel
Johnson Manufacturing Co., Albion, Mich.
Norton Co., 1 New Bond St., Worcester 6, Mass.
Simonds Abrasive Co., Tacony & Fraley Sts., Philadelphia 35, Penna.
Ty-Sa-Man Machine Co., Inc., 1093 White Ave., Knoxville, Tenn.
Wallace Supplies Mfg. Co., 1310 W. Diversey Parkway, Chicago 14, Ill.

CUTTING TOOLS—See Tool Materials

CYLINDERS, Air
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Logansport Mch. Co., Inc., Logansport, Ind.
Skinner Chuck Co., 95 Edgewood Ave., New Britain, Conn.
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CYLINDERS, Hydraulic
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Chicago Pneumatic Tool Co., New York 17, N. Y.
Hydraulic Press Mfg. Co., Mt. Gilead, Ohio.
Logansport Machine Co., Inc., Logansport, Ind.
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Vickers, Inc., Detroit 32, Mich.

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Verson Allsteel Press Co., 93rd St., and S. Kenwood Ave., Chicago, Ill.

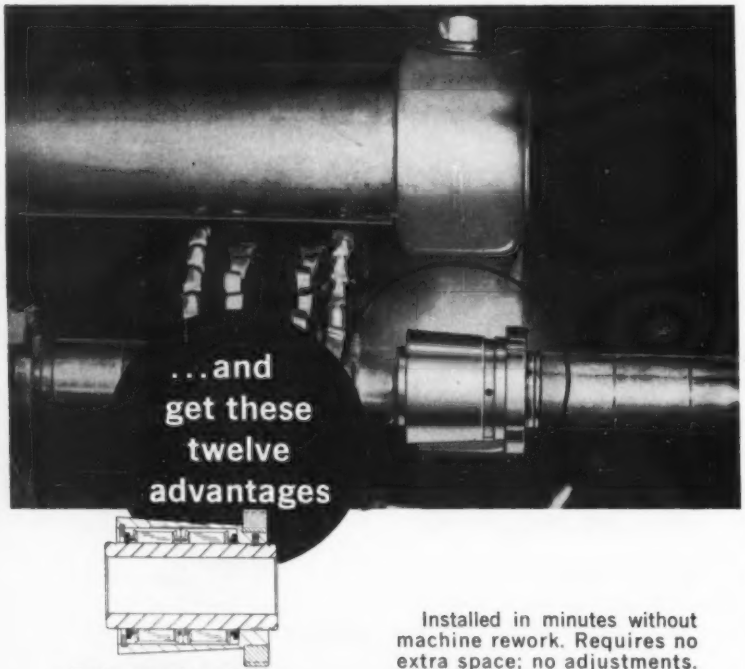
DIE INSERTS, Carbide
Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Kennametal, Inc., Latrobe, Penna.
Metallurgical Products Dept. of General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Vascoloy-Ramet Corp., Waukegan, Ill.

DIE SETS AND DIEMAKERS' SUPPLIES
Bliss, E. W. Co., 1375 Raff Rd., S. W., Canton, Ohio.
Danly Machine Specialties, Inc., 2100 South Laramie, Chicago 50, Ill.
Lempco Industrial, Inc., Bedford, Ohio.
Producto Mch. Co., 985 Housatonic Ave., Bridgeport 1, Conn.
U. S. Tool Co., Inc., 255 North 18th St., Ampere, E. Orange, N. J.
Wales-Strippit, Inc., Akron, N. Y.

DIE SINKING MACHINES—See Milling Machines, Die Sinking, etc.

DIE STOCKS—See Stocks and Dies

Replace the bronze bushing in your
MILLING MACHINE ARBOR SUPPORT
with a Sonnet ROLLER BEARING



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- No bearing heating
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- No twisted arbors
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- Utilizes machine's lubrication system
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- Better finishes
- Less maintenance
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Installed in minutes without machine rework. Requires no extra space; no adjustments. Extra sets of bushings provided to accommodate different size arbors. Permits full range of speeds and feeds of late model milling machines. Carbide cutters can be fully utilized.

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Speed up RIVETING *and* CLINCHING

Automatic feeding and setting with T-J

You'll realize *faster assembly . . . reduced labor costs* immediately, when you use T-J Rivitors and Clinchors for your production line. These performance-proved machines are designed to do a wide range of assembly jobs for aircraft, automotive, farm machinery—riveting jobs of *all* kinds.

T-J RIVITORS automatically feed and set solid rivets with high production. Electrically powered Rivitor sets solid steel rivets up to ⅞″ long. Throat depths 8″ to 36″.

T-J CLINCHORS set clinch nuts with fully automatic operation, controlled by a single foot pedal. Available in Underfeed and Gravity Feed models, throat depths 8″ to 36″.

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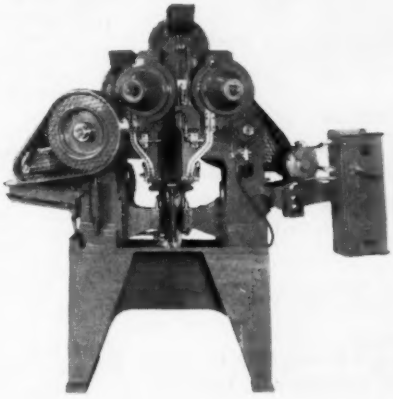
RIVITORS AIR AND HYDRAULIC CYLINDERS CUTTERS CLINCHORS



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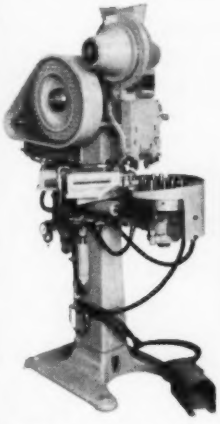
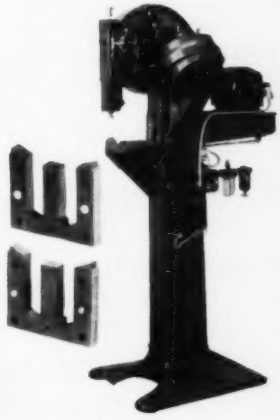


SPECIAL TWIN RIVITOR! Tooled for 6 station indexing fixture, incorporating automatic clamping and ejecting mechanisms, for riveting laminated armature assemblies.



T-J CLINCHOR adapted to a wide range of clinch nut setting problems. Gravity Feed model shown here.

For more data, circle this page number on inquiry card

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Niagara Mch. & Tool Wks., 637 Northland Ave., Buffalo 11, N. Y.
Olofsson Corp., Lansing, Mich.
Ryerson & Son, Inc., Jos. T., 16th & Rockwell St., Chicago 8, Ill.
Vascoloy-Ramet Corp., Waukegan, Ill.
Verson Allsteel Press Co., 93rd St., and S. Kenwood Ave, Chicago, Ill.
Wales-Strippit, Inc., Akron, N. Y.

DIES, Lettering and Embossing
Wales-Strippit, Inc., Akron, N. Y.

DIES, Self-opening Threading
Consolidated Mch. Tool Div., 565 Blossom Rd., Rochester 10, N. Y.
Greenfield Tap & Die Corp., Greenfield, Mass.
Jones & Lamson Mch Co., Springfield, Vt.
Landis Mch Co., Waynesboro, Pa.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.

DIES, Thread Cutting—See Stocks and Dies

DIES, Thread Rolling
Landis Machine Co., Waynesboro, Pa.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.
Pratt & Whitney Co., Inc., West Hartford, Conn.
Reed Rolled Thread Die Co., P. O. Box 350, Worcester 1, Mass.
Sheffield Corp., Box 893, Dayton 1, Ohio.

DIE STEELS
Jessop Steel Co., Washington, Penna.

DISINTEGRATORS
Cincinnati Milling & Grinding Mchs. Inc., Cincinnati 9, Ohio.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.

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DIVIDING HEADS—See Indexing and Spacing Equipment

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Producto Machine Co., 985 Housatonic Ave., Bridgeport, Conn.
U. S. Tool Co., Inc., 255 North 18th St., Ampere, E. Orange, N. J.

DRAWING COMPOUNDS
Oakite Products Inc., 26 Rector St., New York 6, N. Y.

DRESSERS, Grinding Wheel
DoALL Co., 254 N. Laurel Ave., Des Plaines, Ill.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Hamilton Tool Co., 834 S. 9th St., Hamilton, Ohio.
Metal Carbides Corp., Youngstown, Ohio.
Metallurgical Products Dept. of General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
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Norton Co., 1 New Bond St., Worcester, Mass.
Pratt & Whitney Co., Inc., West Hartford, Conn.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio.

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DoALL Co., Des Plaines, Ill.

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Cross Co., P. O. Box 3835, Park Grove Postal Sta., Detroit 5, Mich.
Ettco Tool Co., Inc., 594 Johnson Ave., Brooklyn 37, N. Y.
Jarvis Corp., Middletown, Conn.
Kearney & Trecker Corp.., 6784 W. National, Milwaukee 14, Wis.
Lamb, F. Joseph Co., 5663 E. Nine Mile Rd., Detroit 34, Mich.
Leland Gifford Co., Box 989, Worcester 1, Mass.
National Automatic Tool Co., Richmond, Ind.
Snyder Corp., 3400 E. Fafayette Ave., Detroit 7, Mich.
Thrifmaster Products Corp., 1076 N. Plum St., Lancaster, Pa.
United States Drill Head Co., 616 Burns, Cincinnati, Ohio.
Zagar, Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio.

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Delta Power Tool Div., Rockwell Mfg. Co., Pittsburgh, Pa.
Hartford Special Machinery Co., 287 Homestead Ave., Hartford 12, Conn.
Kingsbury Mch. Tool Corp, Keene, N. H.
Lamb, F. Joseph Co., 5663 E. Nine Mile Rd., Detroit 34, Mich.
Snow Manufacturing Co., Bellwood, Illinois.

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Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland 14, Ohio.
DoAll Co., Des Plaines, Ill.
Greenfield Tap & Die Corp., Greenfield, Mass.
National Automatic Tool Co., Inc., S. 7th & N Sts., Richmond, Ind.

DRILLING ATTACHMENTS, Multiple Spindle—See Drill Heads, Multiple Spindle, and Vises, Machine

DRILLING AND BORING UNITS, Self-contained
Baker Brothers Inc., 1000 Post Ave., Toledo 10, Ohio.
Barnes, W. F. & John Co., Rockford, Ill.
Baush Machine Tool Co., 15 Watson Ave., Springfield, Mass.
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Buhr Machine Tool Co., 839 Greene St., Ann Arbor, Mich.
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Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Leland-Gifford Co., Box 989, Worcester 1, Mass.
National Automatic Tool Co., Inc., S. 7th and N Sts., Richmond, Ind.
Pratt & Whitney Co., Inc., West Hartford, Conn.
Wales-Strippit, Inc., Akron, N. Y.

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Baush Machine Tool Co., 15 Wason Ave., Springfield, Mass.
Bodine Corp., 317 Mt. Grove St., Bridgeport 5, Conn.
Buhr Machine Tool Co., 839 Greene St., Ann Arbor, Mich.
Burgmaster Corp., 15001 S. Figueroa, Gardena, Calif.
Burg Tool and Mfg. Co., Inc., 15001 S. Figueroa, Gardena, Calif.
Cincinnati Bickford Div., Oakley, Cincinnati, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y.
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Fosdick Mch. Tool Co., 1638 Blue Rock, Cincinnati 23, Ohio.
Greenlee Bros. & Co., 136 12th St., Rockford, Ill.
Hamilton Tool Co., 834 So. 9th St., Hamilton, Ohio.
Homestrand, Inc., Larchmont, N. Y.
Ingersoll Milling Machine Co., 505 Fulton Ave., Rockford, Ill.
Lamb, F. Joseph Co., 5663 E. Nine Mile Rd., Detroit 34, Mich.
Leland-Gifford Co., Box 989, Worcester, Mass.
Le Maire Machine Tool Co., 2657 S. Telegraph Rd., Dearborn, Mich.
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Completely New! C-L "Lo-Tork" Drills end stringy chips . . . speed production . . . improve lubrication

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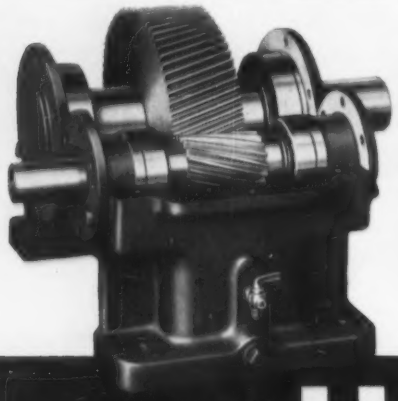

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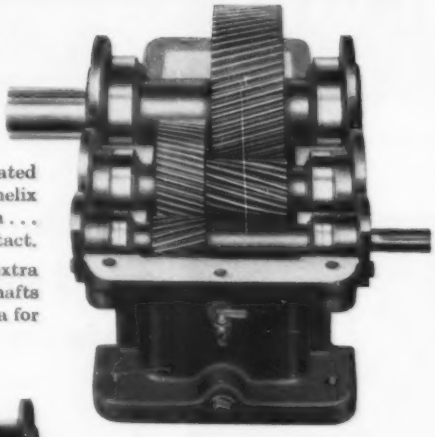
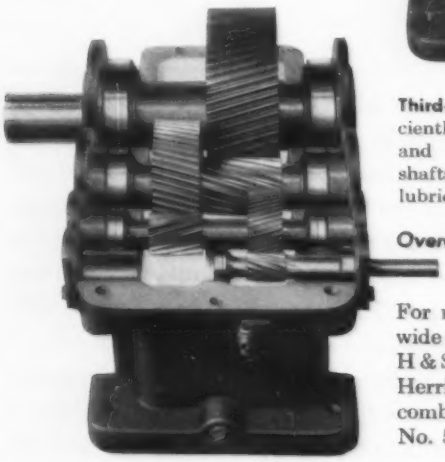
Single · Double · Triple Reduction

Extra rugged construction, simplicity of design are your assurance of consistent day-in-day-out trouble-free operation and exceptionally long service life. Here's why:

First—The helix gears are generated by H & S at the most efficient helix angle to insure smooth operation . . . several teeth are always in contact.

Second—Heavy-duty housings, extra bearing capacity and oversize shafts guarantee ample reserve stamina for the most exacting demands.





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Overall design conforms to AGMA specifications

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Leland-Gifford Co., Box 989, Worcester, Mass.
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Kaukaua Machine & Foundry Div., Giddings & Lewis Machine Tool Co., Kaukauna, Wis.

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Cincinnati Lathe & Tool Co., 3207 Disney St., Cincinnati 9, Ohio.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
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Ingersoll Milling Mch. Co., 2442 Douglas St.,
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Wales-Strippit, Inc., Akron, N. Y.

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DoAll Co., Des Plaines, Ill.
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DRILLS, Core
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Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland 14, Ohio.
DoAll Co., Des Plaines, Ill.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Greenfield Tap & Die Corp., Greenfield, Mass.
Metallurgical Products Dept. of General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
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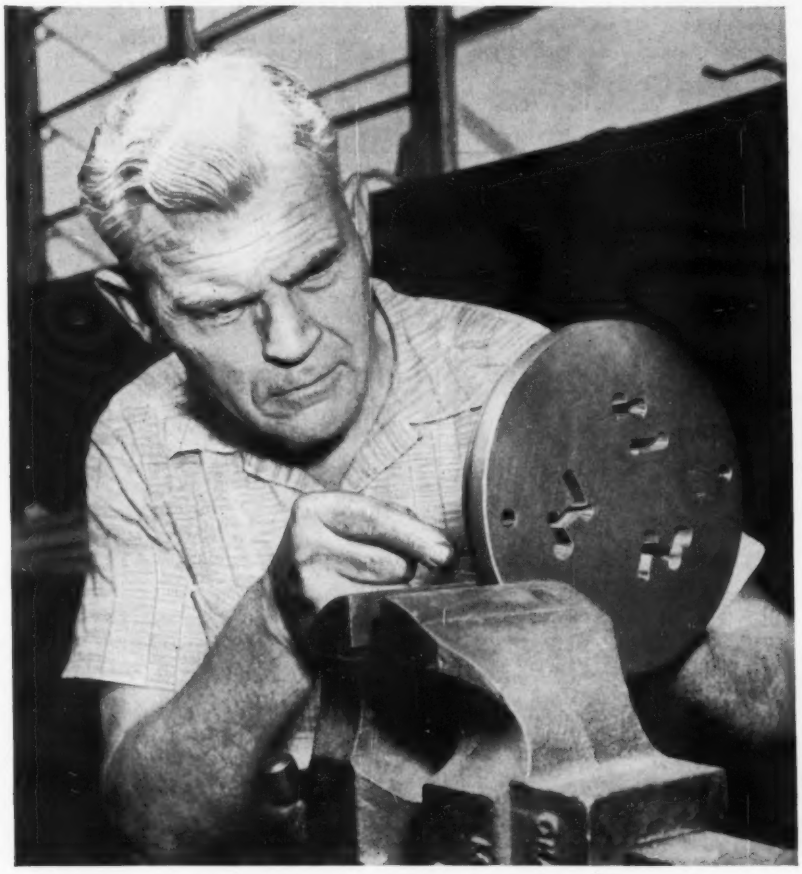
Tool Steel Topics

BETHLEHEM STEEL

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.



Making "3-in. edge" extrusions with die of Cromo-WV

A manufacturer in the Southeast needed a long wearing hot-work tool steel to produce a "3-in. edge" extrusion made of aluminum. They talked it over with our local tool steel distributor who recommended making the die from a Bethlehem Cromo-WV upset-forged disc.

It was a good choice. The disc machined readily, and was easy to heat-treat. Hardened to Rockwell C47, the die extrudes 24 billets per hour, with brief stops for polishing. The life of the die is about 50,000 lb of extruded metal.

Cromo-WV, with its 5 pct chrome content, plus .30 pct vanadium, is a modification of our popular Cromo-W, the original 5 pct chrome hot-work steel. Resistant to heat checking, Cromo-WV also has good red hardness, and good shock resistance.

Like to give Cromo-WV a try? Just call your Bethlehem tool steel distributor. You'll find he will handle your request promptly.

BETHLEHEM TOOL STEEL ENGINEER SAYS:

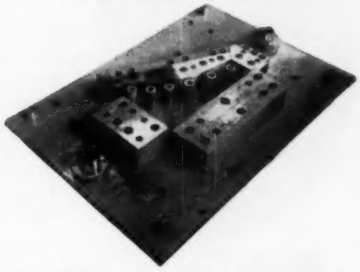
Drilled Holes Are Not Round (Usually)

Round holes which are drilled in tool steel stock with twist drills, if measured accurately, are usually found to be: 1. out of round; 2. oversize (compared with drill diameter); and 3. tapered throughout their depth. In other words a half-inch-diameter hole cannot be drilled with a half-inch-diameter drill.

This condition results largely from mechanical "play" in the drilling equipment, although many other factors can exert considerable influence. For example, if the two ground lips which form the cutting edges of a twist drill are unequal in length, the drill will produce holes of irregular size and shape.

The production of parts containing accurate round holes is most commonly accomplished by rough-drilling the holes undersize, and then either reaming or broaching to obtain the desired size.

Bethlehem Air-4 Is an Ideal Free-Machining Grade



Air-4, Bethlehem's new medium alloy tool steel, is an ideal free-machining grade due to the addition of lead. It hardens in air at 1525F to 1575F, and provides excellent wear and high toughness. Air-4 is also a deep-hardening grade, with high compressive strength. Order it today from your Bethlehem tool steel distributor.

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Specify **H & S**
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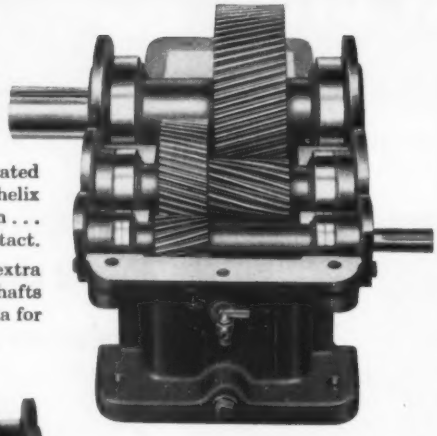
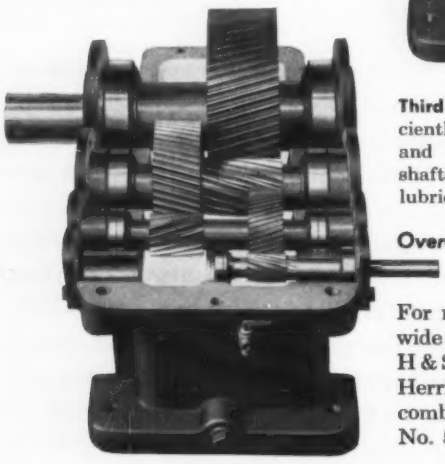
Single · Double · Triple Reduction

Extra rugged construction, simplicity of design are your assurance of consistent day-in-day-out trouble-free operation and exceptionally long service life. Here's why:

First—The helix gears are generated by H & S at the most efficient helix angle to insure smooth operation . . . several teeth are always in contact.

Second—Heavy-duty housings, extra bearing capacity and oversize shafts guarantee ample reserve stamina for the most exacting demands.





Third—Bearings and gears are efficiently splash lubricated, and dust and oil-proof seals on extending shafts keep out trouble—keep in lubricant.

Overall design conforms to AGMA specifications

For more detailed specifications, wide size and capacity range of H & S Speed Reducers (Helical, Herringbone, Worm Gear and combinations) write for Catalog No. 55.

THE HORSBURGH & SCOTT CO.
GEARS AND SPEED REDUCERS
5112 Hamilton Avenue • Cleveland 14, Ohio

DRILLING MACHINES, Radial
American Tool Works Co., Pearl & Eggleston Ave., Cincinnati, Ohio.
Burg Tool and Mfg. Co., Inc., 15001 S. Figueroa, Gardena, Calif.
Cincinnati Bickford Div., Oakley, Cincinnati, Ohio.
Cincinnati Gilbert Machine Tool Co., 3366 Beekman St., Cincinnati 23, Ohio.
Cincinnati Lathe & Tool Co., 3207 Disney St., Cincinnati 9, Ohio.
Cleveland Punch & Shear Works Co., 3917 St. Clair Ave., Cleveland 14, Ohio.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Fosdick Mch. Tool Co., 1638 Blue Rock, Cincinnati 23, Ohio.
Homestrand, Inc., Larchmont, N. Y.

DRILLING MACHINES, Sensitive
Baker Brothers Inc., 1000 Post Ave., Toledo 10, Ohio.
Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
Burgmaster Corp., 15001 S. Figueroa, Gardena, Calif.
Burg Tool and Mfg. Co., Inc., 15001 S. Figuera, Gardena, Calif.
Cincinnati Bickford Div., Oakley, Cincinnati, Ohio.
Cincinnati Lathe & Tool Co., 3207-3211 Disney St., Cincinnati 9, Ohio.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Edlund Machinery Co. Div., Cortland, N. Y.
Fosdick Mch. Tool Co., 1638 Blue Rock, St., Cincinnati 23, Ohio.
Hamilton Tool Co., 834 S. 9th St., Hamilton, Ohio.
Leland-Gifford Co., Box 989, Worcester, Mass.
National Automatic Tool Co., Inc., S. 7th and N Sts., Richmond, Ind.
Snow Manufacturing Co., Bellwood, Illinois.
Olivetti Corp. of America, 42-33 Northern Blvd., Long Island City 1, N. Y.
Wales-Strippit, Inc., Akron, N. Y.

DRILLING MACHINES, Universal Radial
Kaukaua Machine & Foundry Div., Giddings & Lewis Machine Tool Co., Kaukauna, Wis.

DRILLING MACHINES, Upright
Baker Brothers Inc., 1000 Post Ave., Toledo 10, Ohio.
Barnes, W. F. & John Co., Rockford, Ill.
Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
Burgmaster Corp., 15001 S. Figueroa, Gardena, Calif.
Burg Tool and Mfg. Co., Inc., 15001 S. Figueroa, Gardena, Calif.
Cincinnati Bickford Div., Oakley, Cincinnati, Ohio.
Cincinnati Lathe & Tool Co., 3207 Disney St., Cincinnati 9, Ohio.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Ettco Tool Co., Inc., 594 Johnson Ave., Brooklyn 37, N. Y.
Fosdick Mch. Tool Co., 1638 Blue Rock, Cincinnati 23, Ohio.
Homestrand, Inc., Larchmont, N. Y.
Ingersoll Milling Mch. Co., 2442 Douglas St.,
Le Maire Machine Tool Co., 2657 S. Telegraph Rd., Dearborn, Mich.
National Automatic Tool Co., Inc., S. 7th and N Sts., Richmond, Ind.
Rehnberg-Jacobson Mfg. Co., 2135 Kishwaukee St., Rockford, Ill.
Snow Manufacturing Co., Bellwood, Ill.
Wales-Strippit, Inc., Akron, N. Y.

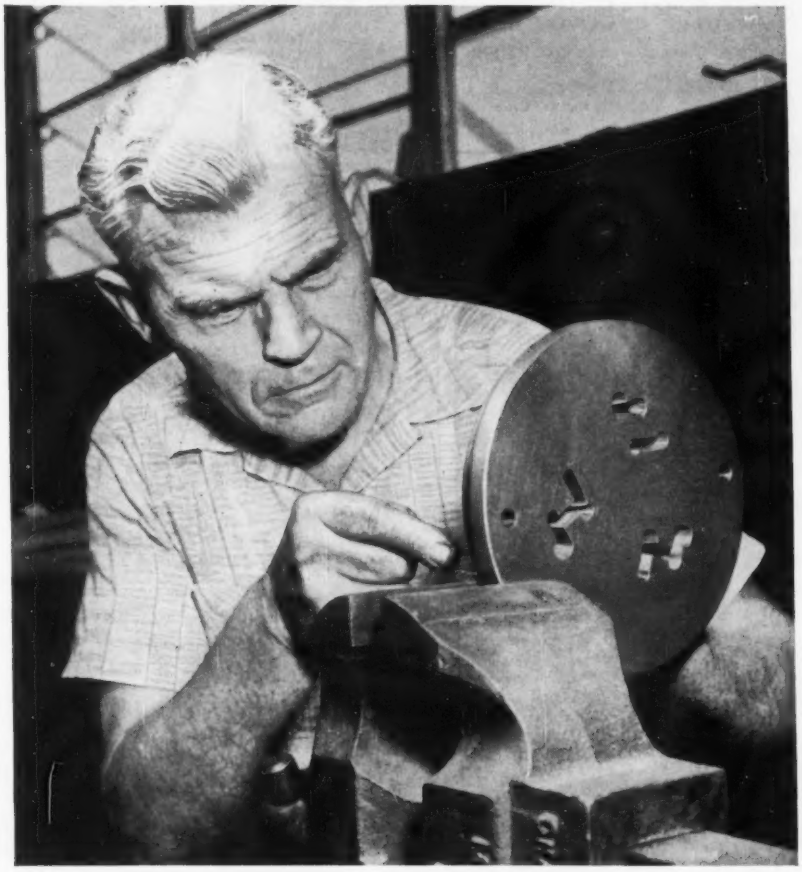
DRILLS, Center
Chicago-Latrobe, 411 W. Ontario St., Chicago 10, Ill.
Circular Tool Co., 765 Allens Ave., Providence 5, R. I.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
Cogsdill Twist Drill Co., Greenfield, Mass.
DoAll Co., Des Plaines, Ill.
Greenfield Tap & Die Corp., Greenfield, Mass.
Threadwell Tap & Die Co., 16 Arch St., Greenfield, Mass.

DRILLS, Core
Chicago-Latrobe, 411 W. Ontario St., Chicago 10, Ill.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland 14, Ohio.
DoAll Co., Des Plaines, Ill.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Greenfield Tap & Die Corp., Greenfield, Mass.
Metallurgical Products Dept. of General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Mohawk Tools, Inc., Mntpelier, Ohio.
Wesson Co., 1220 Woodward Heights Blvd., Detroit 20, Mich.

Tool Steel Topics

BETHLEHEM STEEL

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.



Making "3-in. edge" extrusions with die of Cromo-WV

A manufacturer in the Southeast needed a long wearing hot-work tool steel to produce a "3-in. edge" extrusion made of aluminum. They talked it over with our local tool steel distributor who recommended making the die from a Bethlehem Cromo-WV upset-forged disc.

It was a good choice. The disc machined readily, and was easy to heat-treat. Hardened to Rockwell C47, the die extrudes 24 billets per hour, with brief stops for polishing. The life of the die is about 50,000 lb of extruded metal.

Cromo-WV, with its 5 pct chrome content, plus .30 pct vanadium, is a modification of our popular Cromo-W, the original 5 pct chrome hot-work steel. Resistant to heat checking, Cromo-WV also has good red hardness, and good shock resistance.

Like to give Cromo-WV a try? Just call your Bethlehem tool steel distributor. You'll find he will handle your request promptly.

BETHLEHEM TOOL STEEL ENGINEER SAYS:

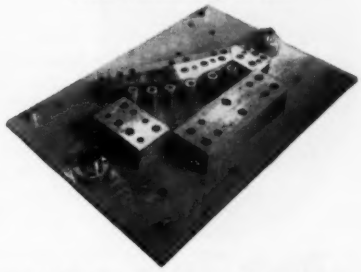
Drilled Holes Are Not Round (Usually)

Round holes which are drilled in tool steel stock with twist drills, if measured accurately, are usually found to be: 1. out of round; 2. oversize (compared with drill diameter); and 3. tapered throughout their depth. In other words a half-inch-diameter hole cannot be drilled with a half-inch-diameter drill.

This condition results largely from mechanical "play" in the drilling equipment, although many other factors can exert considerable influence. For example, if the two ground lips which form the cutting edges of a twist drill are unequal in length, the drill will produce holes of irregular size and shape.

The production of parts containing accurate round holes is most commonly accomplished by rough-drilling the holes undersize, and then either reaming or broaching to obtain the desired size.

Bethlehem Air-4 Is an Ideal Free-Machining Grade



Air-4, Bethlehem's new medium alloy tool steel, is an ideal free-machining grade due to the addition of lead. It hardens in air at 1525F to 1575F, and provides excellent wear and high toughness. Air-4 is also a deep-hardening grade, with high compressive strength. Order it today from your Bethlehem tool steel distributor.

DRILLS, Deep Hole, Gun
Chicago-Latrobe, 411 W. Ontario St., Chicago 10, Ill.
Greenfield Tap & Die Corp., Greenfield, Mass.

DRILLS, Oil Hole, Oil Tube
Chicago-Latrobe, 411 W. Ontario St., Chicago 10, Ill.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland 14, Ohio.
DoAll Co., Des Plaines, Ill.
Greenfield Tap & Die Corp., Greenfield, Mass.

DRILLS, Portable Electric
Chicago Pneumatic Tool Co., New York 17 N. Y.

DRILLS, Portable pneumatic
Chicago Pneumatic Tool Co., New York 17, N. Y.

DRILLS, Ratchet
Armstrong Bros. Tool Co., 5213 W. Armstrong Ave., Chicago 46, Ill.
Chicago-Latrobe, 411 W. Ontario St., Chicago 10, Ill.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland 14, Ohio

DRILLS, Subland
Chicago-Latrobe, 411 W. Ontario St., Chicago 10, Ill.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland 14, Ohio.
DoAll Co., Des Plaines, Ill.
Greenfield Tap & Die Corp., Greenfield, Mass.
Mohawk Tools, Inc., Montpelier, Ohio.

DRILLS, Twist, High-Speed Steel, Carbon Steel
Chicago-Latrobe, 411 W. Ontario St., Chicago 10, Ill.
Cleveland Twist Drill Co., 1242 49th St., Cleveland 14, Ohio
DoAll Co., Des Plaines, Ill.
Greenfield Tap & Die Corp., Greenfield Mass.
Mohawk Tools, Inc., Montpelier, Ohio
Threadwell Tap & Die Co., 16 Arch, Greenfield, Mass.

DRILLS, Twist, Carbide, Carbide-Tipped
Allegheny Ludlum Steel Corp., Oliver Bldg., Pittsburgh 22, Pa
Chicago-Latrobe, 411 W. Ontario St., Chicago 10, Ill.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland 14, Ohio.
DoAll Co., Des Plaines, Ill.
Threadwell Tap & Die Co., 16 Arch, Greenfield, Mass.

DRILLS, Wire
Chicago-Latrobe, 411 W. Ontario St., Chicago 10, Ill.
Cleveland Twist Drill Co., Cleveland, Ohio.
Cogsdill Twist Drill Co., Greenfield, Mass.
Greenfield Tap & Die Corp., Greenfield, Mass.
National Twist Drill & Tool Co., Rochester, Mich.

DUPLICATING ATTACHMENTS—See Tracing Attachments

DUST COLLECTORS AND CONTROL SYSTEMS
Brown & Sharpe Mfg. Co., Providence, R. I.
Hammond Machinery Builders, Inc., Kalamazoo, Mich.
Pangborn Corp., Hagerstown, Md.
Standard Electrical Tool Co., 2500 River Rd. Cincinnati 14, Ohio.

ELECTRICAL DISCHARGE MACHINES
—See Disintegrators

ELECTRONIC CONTROL SYSTEMS
Micro-Path Inc., Ingelwood 2, Calif.
Stromberg-Carlson Div., General Dynamics Corp., 1493 N. Goodman St. Rochester 3, N. Y.

ENGRAVING MACHINES
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Gorton, Geo., Mach., 1321 Racine St., Racine, Wis.

EXTRACTORS, Screw
Chicago-Latrobe, 411 W. Ontario St., Chicago 10, Ill.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland 14, Ohio.
Greenfield Tap & Die Corp., Greenfield, Mass.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

FACING HEADS
Baker Brothers Inc., 1000 Post Ave., Toledo 10, Ohio.
Cross Co., P. O. Box 3835, Park Grove Postal Sta., Detroit 5, Mich.
Davis Boring Tool Div., Giddings & Lewis Mch. Tool Co., Fond du Lac, Wis.
Kaukauna Machine & Foundry Div., Giddings & Lewis Machine Tool Co., Kaukauna, Wis.
Mummert-Dixon Co., Hanover, Pa.

FANS, Exhaust, Ventilating
Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.

FASTENERS
Allen Mfg. Co., Bloomfield, Conn.
Bethlehem Steel Co., 701 East Third St., Bethlehem, Pa.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

Johnson Model J (Wet or Dry) Cuts anything in your stock pile. 10" rounds, 18" flats, structurals or odd shapes. Centralized controls, special safety features, variable speeds.

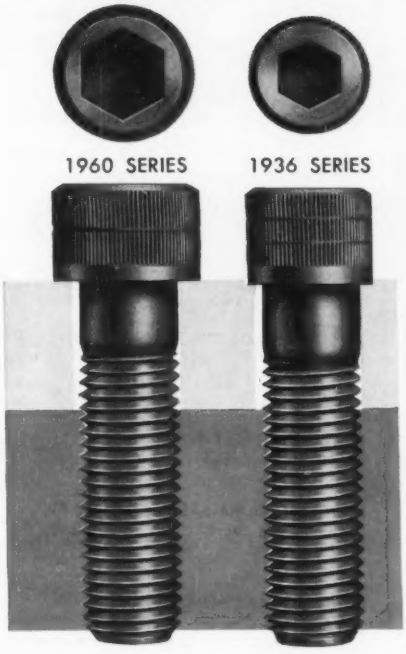
that costs you NOTHING!

True, you pay the low initial purchase price, but the big, rugged Johnson Model J is so well engineered, so dependable, so troublefree—so versatile, fast and accurate, that it quickly pays for itself in tangible savings. One Johnson metal cutting band saw . . . or a battery of them, will pay you big dividends in time, labor—smooth production and eliminate scrap.

Write Today . . . for your copy of the new Johnson catalog. All models and accessories described, illustrated in full.

Johnson MANUFACTURING CORPORATION
1016 Barnes Street Albion, Michigan

Allen's *New '60 Series* Socket Head Cap Screws



give up to 2⅓ times more load carrying capacity ...without indentation!

In Allen's new '60 Series, head diameter of sizes from ¼" up is now uniformly one and one-half times the body diameter. In many sizes (where this ratio was not called for by 1936 Series specifications) this will provide *more* under-the-head bearing surface, and a proportionate *increase* in clamping force. Loads are more evenly distributed, and the greater bearing area in many cases eliminates need for washers.

Socket sizes have been increased in many cases—greater wrenching area permits higher tightening torque—which resists fatigue failure, and lengthens the life of the threaded joint.

- A new 2-band knurl will identify all ALLEN Cap Screws (except Stainless Steel) that conform to the new '60 Series specifications. New labels on boxes will also identify these.
- The 1936 Series of Allen Cap Screws will continue to be available.

COMPARISON OF ALLEN 1960 SERIES AND 1936 SERIES SOCKET HEAD CAP SCREWS

SCREW SIZE	HEAD DIAMETER Minimum (inches)		BEARING SURFACE Minimum (square inches)		PERCENT OF INCREASE IN BEARING SURFACE[1]	TENSILE LOAD TO INDENT IN SOFT STEEL[2] (lbs.)		TORQUE INDUCED TENSILE LOAD TO INDENT IN SOFT STEEL[2] (lbs.)	
	1960 Series	1936 Series	1960 Series	1936 Series		1960 Series	1936 Series	1960 Series	1936 Series
¼	.365	.367	.044	.044	—	4,750	4,750	2,780	2,780
5/16	.457	.429	.070	.052	33	7,440	5,600	4,380	3,300
3/8	.550	.553	.111	.111	—	12,100	12,100	7,000	7,000
7/16	.642	.615	.140	.103	36	15,000	11,000	8,850	6,450
½	.735	.739	.183	.183	—	19,500	19,500	11,500	11,500
5/8	.921	.863	.293	.216	35	31,000	23,200	18,500	13,600
¾	1.107	.987	.424	.224	89	45,000	24,000	26,700	14,100
⅞	1.293	1.111	.585	.253	131	62,500	27,000	36,800	15,900
1	1.479	1.297	.768	.405	89	82,000	43,500	48,500	25,500

[1]Head tolerance revisions on Sizes #0 thru #10, ¼, ⅜, and ½ diameter have no significant effect on bearing surface or holding power of screws.

[2]Values based on .00025 inch indentation.

Ask your Industrial Distributor about ALLEN '60 Series Cap Screws.
Write for samples and complete specifications. Ask for Bulletin G-25.

ALLEN MANUFACTURING COMPANY
Hartford 1, Connecticut, U.S.A.

Stocked and sold by leading industrial distributors everywhere

ALLEN HEX-SOCKET SCREWS HEAD

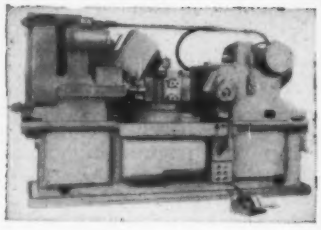
For more data, circle this page number on inquiry card

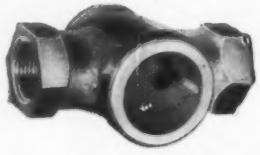
...and parts are finished without rehandling on

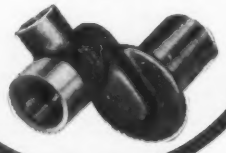
GOSS & DeLEEUW AUTOMATIC CHUCKING MACHINES

The Goss & De Leeuw "One-Two-Three" Chucker differs from the conventional machine in that it provides the means of machining more than one end of a piece in a single handling instead of requiring several handlings and set-ups. A worthwhile gain in production time is assured.

In the "1-2-3", work is gripped in chuck and all ends machined either in sequence or simultaneously. Goss & De Leeuw and only Goss & De Leeuw offers this feature in a standard chucking machine.







A few typical parts finished on this machine are shown here. Write for detailed description . . . send samples of your work for time and cost estimates.

GOSS & DeLEEUW QUALITY PRODUCT-QUANTITY

GOSS and DE LEEUW
MACHINE COMPANY, KENSINGTON, CONN., U.S.A

FEEDERS, Automatic
Gear-O-Mation Div., Michigan Tool Co., 7171 McNichols Rd., Detroit 12, Mich.
Lamb, F. Joseph Co., 5663 E. Nine Mile Rd., Detroit 34, Mich.

FILES, Band
DoALL Co., Des Plaines, Ill.

FILES, General-purpose, Swiss Pattern
DoALL Co., Des Plaines, Ill.

FILES AND BURRS, Rotary
DoALL Co., Des Plaines, Ill.
Jarvis Corp., Middletown, Conn.
Pratt & Whitney Co., Inc., West Hartford, Conn.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.

FILING MACHINES
Chicago Pneumatic Tool Co., New York 17, N. Y.
DoALL Co., Des Plaines, Ill.
Oliver Instrument Co., 1410 E. Maumee St., Adrian, Mich.

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Barnes Drill Co., 814 Chestnut St., Rockford, Ill.
Cuno Engineering Corp., Meriden, Conn.
Johnson, S. C. & Son, Inc., Racine, Wis.
Marvel Engineering Co., 7227 N. Hamlin Ave., Chicago 45, Ill.

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Cincinnati Milling and Grinding Mchs., Inc., Cincinnati 9, Ohio.
Gleason Works, 1000 University Ave., Rochester 3, N. Y.

FLEXIBLE SHAFT EQUIPMENT
Jarvis Corp., Middletown, Conn.

FORGING HAMMERS, Steam and Air
Chambersburg Engrg. Co., Chambersburg, Pa.
Erie Foundry Co., 1253 W. 12th St., Erie, Penna.

FORGING MACHINES, Headers, Upsetters, Presses
Ajax Mfg. Co., 1441 Chardon Rd., Cleveland 17, Ohio
Bliss, E. W. Co., 1375 Raff Rd. S. W. Canton, Ohio
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio
National Machinery Co., Tiffin, Ohio
Waterbury Farrel Foundry & Mch. Co., Waterbury, Conn.

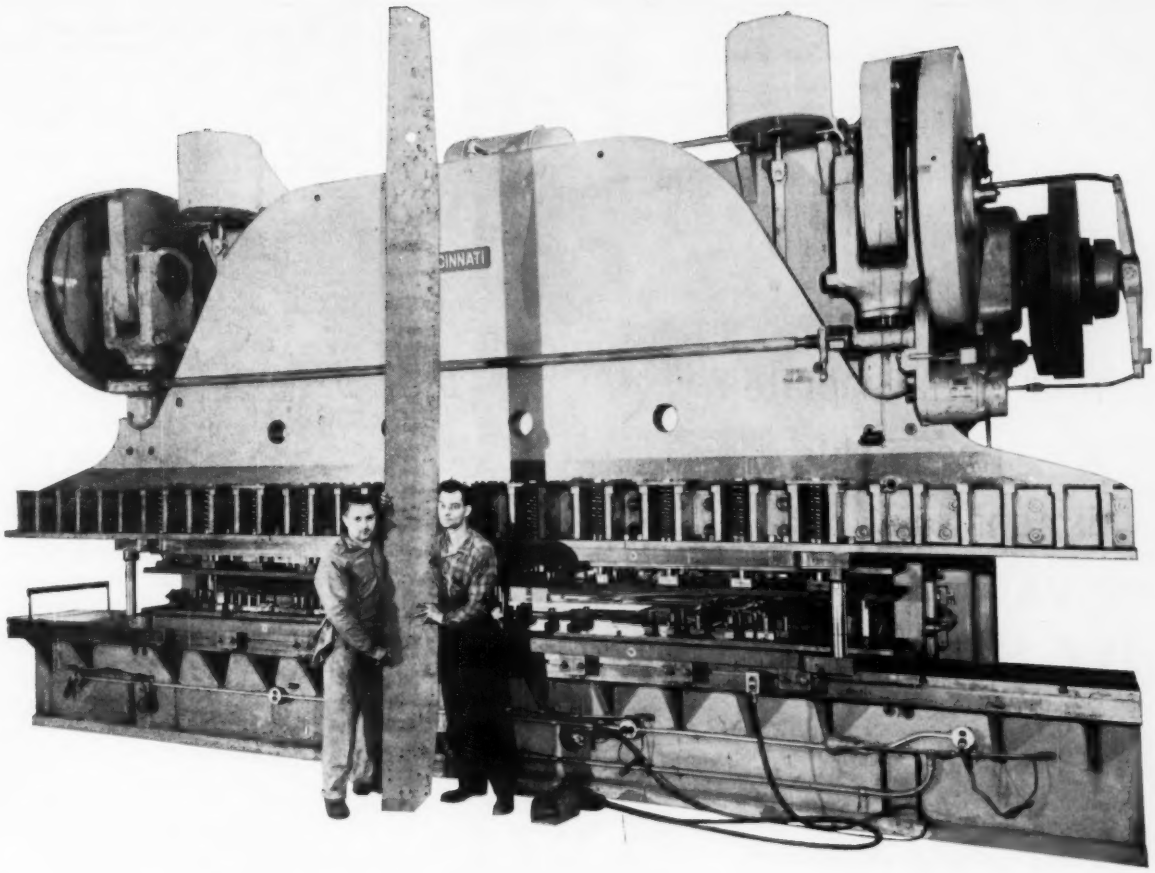
FORGING, Hollow-Bored
Bethlehem Steel Co., 701 East Third St., Bethlehem, Pa.
Mueller Brass Co., Port Huron 35, Mich.

FORGINGS, Drop
Bethlehem Steel Co., 701 East Third St., Bethlehem, Pa.
Mueller Brass Co., Port Huron 35, Mich.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

FORGINGS, Press
Bethlehem Steel Co., 701 East Third St., Bethlehem, Pa.
Cleveland Punch & Shear Works Co., 3917 St. Clair Ave., Cleveland 14, Ohio
Minster Mch. Co., Minster, Ohio
Mueller Brass Co., Port Huron 35, Mich.
Revere Copper & Brass Inc., 230 Park Ave., New York 17, N. Y. (die-pressed)
Vanadium-Alloys Steel Co., Latrobe, Penna.

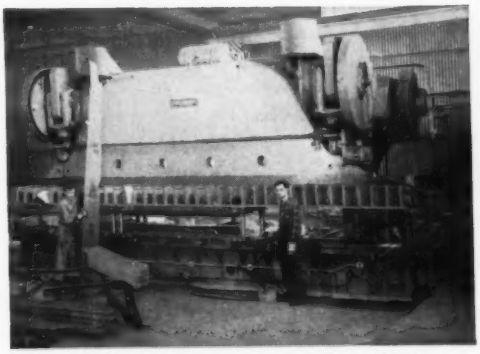
FORGINGS, Upset
Bethlehem Steel Co., 701 East Third St., Bethlehem, Pa.
Vanadium-Alloys Steel Co., Latrobe, Penna.

FORMING MACHINES, Cold-Rolling
Hydraulic Press Mfg. Co., Mount Gilead, Ohio
Michigan Tool Co., Mount Gilead, Ohio
Detroit 12, Mich.
Niagara Mch. & Tool Works, 637 Northland Ave., Buffalo, N. Y.
Yoder Co., 5500 Walworth, Cleveland, Ohio



Punching floor-to-floor time cut from 36 to 1⅓ minutes.

70 minutes cut to 2.6 min.



Blanking floor-to-floor time cut from 34 to 1¼ minutes.

In combined blanking and punching operations, production time has been cut 96.2% on these long truck side rail reinforcements, thanks to the versatility of this Cincinnati® All-Steel Press Brake.

Operating data, furnished by John L. Hayner, President of Fort Wayne Structural Steel Co., Inc., show how his company slashed production costs so substantially.

They decreased floor-to-floor time from 34 minutes to 1¼ minutes on blanking ¼" C1010 Steel with a 202" cutting edge. By punching 130 holes per stroke, they reduced floor-to-floor time from 36 minutes to 1⅓ minutes.

Talk with our Application Engineering department about applying a time-cutting Cincinnati Press Brake in your shop. It can be the most profitable decision you've made this year. Write Department D for Press Brake catalog.

Shapers / Shears / Press Brakes

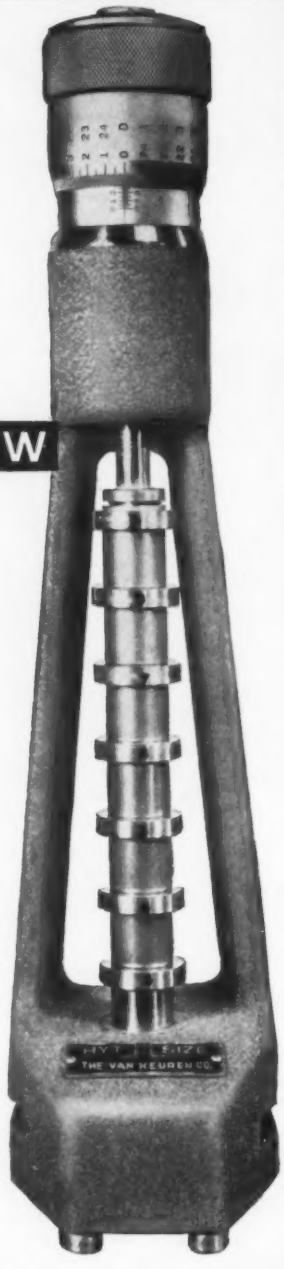
THE CINCINNATI SHAPER CO.

Cincinnati 11, Ohio, U.S.A.

For more data, circle this page number on inquiry card

HYT Size Gage, 10" model

Available accessories:
18" transfer gage
3" and 6" riser blocks



Your surface plate needs this NEW dimensional gage, the **VAN KEUREN HYT SIZE GAGE**

Here's why:

- it embodies the well-known *Van Keuren precision.*
- it has a decided price advantage.
- permits amazing speed in setting all dimensions (a matter of a few seconds!)
- it's accurate to .000050" over entire range.
- has exclusive design features: a patented spring-loaded non-rotating spindle eliminates backlash . . . measuring surfaces are accessible from front and back . . . it can be used in a horizontal position.
- it's ruggedly built for long life.
- easily portable . . . can be used anywhere in shop.

Now you can more quickly inspect drill jigs, lathe fixtures, gears, cams, splines, profiles, contours . . . and check many shop operations. You can easily set precision depths on drill presses, milling machines, jig borers, etc.

Write today for descriptive bulletin

VK

THE Van Keuren CO.
Since 1920
178 Waltham Street, Watertown 72, Mass.
PRECISION MEASURING TOOLS
. . . rated the world's most accurate
Plug Gages · Measuring Wires · Optical Flats and Light Wave Equipment · Gage Blocks · Precision Lapping Service and Parts

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Bliss, E. W. Co., 1375 Raff Rd., S. W., Canton, Ohio
Brown & Sharpe Mfg. Co., Providence, R. I.
Chambersburg Engrg. Co., Chambersburg, Pa.
Clearing Div., of U. S. Industries, Inc., 6499 W. 65th St., Chicago 38, Ill.
U. S. Tool Co., Inc., 255 North Main St., Ampere, E. Orange, N. J.

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National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.

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DoALL Co., Des Plaines, Ill.
Pratt & Whitney Co., Inc., West Hartford, Conn.
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.

GAGES, Air Comparator
Federal Products Corp., 1144 Eddy St., Providence 1, R. I.
Pratt & Whitney Co., Inc., West Hartford, Conn.
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.
Sheffield Corp., Box 893, Dayton 1, Ohio

GAGES, Automatic Sorting
Federal Products Corp., 1144 Eddy St., Providence 1, R. I.
Sheffield Corp., Box 893, Dayton 1, Ohio

GAGES, DIAL, Bore, Height, Depth, Thread, Groove, etc.
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Brown & Sharpe Mfg. Co., Providence, R. I.
Cadillac Gage Co., P. O. Box 3806, Detroit, Mich.
DoALL Co., Des Plaines, Ill.
Federal Products Corp., 1144 Eddy St., Providence 1, R. I.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.
Starrett, The L. S. Co., Athol, Mass.

GAGES Electric Comparator
Brown & Sharpe Mfg. Co., Providence, R. I.
DoALL Co., Des Plaines, Ill.
Federal Products Corp., 1144 Eddy St., Providence 1, R. I.
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Federal Products Corp., 1144 Eddy St., Providence 1, R. I.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

GAGES, Multiple Inspection
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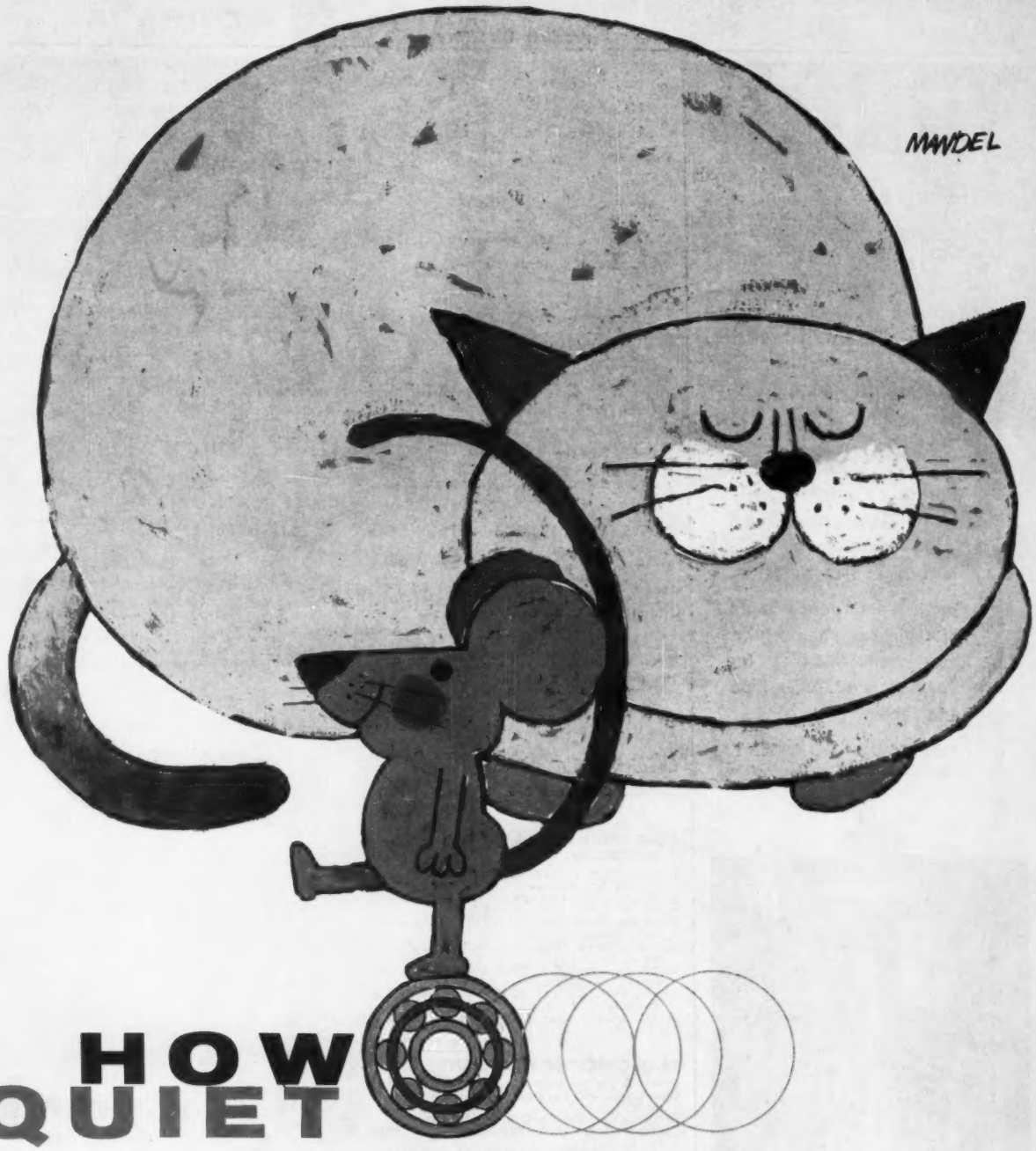
Pratt & Whitney Co., Inc., West Hartford, Conn.
Sheffield Corp., Box 893, Dayton 1, Ohio



HOW QUIET can a ball bearing be?

Federal Ball Bearings are to be seen, but not heard! Elusive noises are intercepted by inspection engineers at "quiet control" points all along our production line. They want to hear the soft, sweet purr that signifies a perfect bearing, because that's the only kind we'll tolerate. That's why every bearing goes through scores of quality control tests before we send it out. Customers who get these perfect bearings number among the most respected names in American industry. We'd like to include you. Start with our catalog—over 12,000 ball bearing sizes, hundreds of types. Send for it today.

THE FEDERAL BEARINGS CO., INC., Poughkeepsie, N. Y.

Federal
BALL BEARINGS

One of America's largest ball bearing manufacturers

FEDERAL ON FILM—A 16 mm. color sound film takes you through our 400,000 sq. ft. plant. Loaned free. Just ask for it.

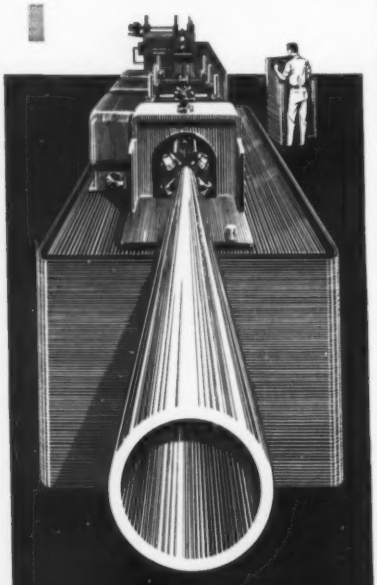
YODER

Pipe and Tube Mills

Product dependability—integrity of manufacture—engineering for specific production needs have all contributed to establish Yoder equipment as the industry standard of excellence. Since 1909 Yoder-built machinery, including Pipe and Tube Mills, Roll Forming Equipment and Rotary Slitters, have earned world-wide customer satisfaction and recognition.

Profit from Yoder's years of engineering and service experience. Send today for the illustrated Yoder Pipe and Tube Mills Book.

THE YODER COMPANY
5504 Walworth Ave., Cleveland 2, Ohio



PIPE AND TUBE MILLS
(ferrous or non-ferrous)
COLD ROLL FORMING MACHINES
ROTARY SLITTING LINES

GAGES, Plug and Ring
Brown & Sharpe Mfg. Co., Providence, R. I.
DoAll Co., Des Plaines, Ill.
Greenfield Tap & Die Corp., Greenfield, Mass.
Metallurgical Products Dept. of General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Pratt & Whitney Co., Inc., West Hartford, Conn.
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.
Sheffield Corp., Box 893, Dayton 1, Ohio
Threadwell Tap & Die Co., 16 Arch, Greenfield, Mass.
Van Keuren Co., 176 Waltham St., Watertown 72, Mass.
Winter Bros. Co., Rochester, Mich.

GAGES, Roll Thread Snap, Adjustable Snap
Federal Products Corp., 1144 Eddy St., Providence 1, R. I.
Greenfield Tap & Die Corp., Greenfield, Mass.
Sheffield Corp., Box 893, Dayton 1, Ohio
Threadwell Tap & Die Co., 16 Arch, Greenfield, Mass.

GAGES, Surface Roughness
DoAll Co., Des Plaines, Ill.
Sheffield Corp., Box 893, Dayton 1, Ohio

GAGES, VERNIER, Height, Depth, Gear Tooth
Brown & Sharpe Mfg. Co., Providence, R. I.
DoAll Co., Des Plaines, Ill.
Federal Products Corp., 1144 Eddy St., Providence 1, R. I.
Starrett, The L. S., Co., Athol, Mass.

GASKETS
Houghton, E. F. & Co., 303 W. Lehigh Ave., Philadelphia 33 Penna.

GEAR BURNISHERS
Fellows Gear Shaper Co., Springfield, Vt.
Gleason Works, 1000 University Ave., Rochester 3, N. Y.
Sheffield Corp., Box 893, Dayton 1, Ohio

GEAR CHAMFERING, ROUNDING AND DEBURRING MACHINES
Bilgram Gear & Mch. Works, 1217-35 Spring Garden St., Philadelphia, Pa.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Cross Co., P. O. Box 3835, Park Grove Postal Sta., Detroit 5, Mich.
Gleason Works, 1000 University Ave., Rochester 3, N. Y.
Lamb, F. Joseph Co., 5663 E. Nine Mile Rd., Detroit 34, Mich.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Sheffield Corp., Box 893, Dayton 1, Ohio

GEAR CHECKING EQUIPMENT
Brown & Sharpe Mfg. Co., Providence, R. I.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Fellows Gear Shaper Co., Springfield, Vt.
Gleason Works, 1000 University Ave., Rochester 3, N. Y.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.

GEAR CUTTING MACHINES, Bevel and Spiral
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Gleason Works, 1000 University Ave., Rochester 3, N. Y.
Orban Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.

GEAR CUTTING MACHINES, Worm and Worm Wheels
Barber-Colman Co., 1300 Rock St., Rockford, Ill.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Gleason Works, 1000 University Ave., Rochester 3, N. Y.
New Jersey Gear & Mfg. Co., 1470 Chestnut Ave., Hillside, N. J.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.

GEAR GRINDERS—See Grinding Machines, Gear

GEAR HOBBERS
American Schiess Corp., 1232 Penn. Ave., Pittsburgh 22, Pa.
Barber-Colman Co., 1300 Rock St., Rockford, Ill.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Fellows Gear Shaper Co., Springfield, Vt.
Hamilton Tool Co., 834 S. 9th St., Hamilton, Ohio
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.

GEAR HONERS
National Broach & Mch. Co., 5600 St. Jean, Detroit 13, Mich.

GEAR LAPPERS
Fellows Gear Shaper Co., Springfield, Vt.
Gleason Works, 1000 University Ave., Rochester 3, N. Y.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
National Broach & Mch. Co., 5600 St. Jean, Detroit 12, Mich.

GEAR MOTORS—See Speed Reducers

GEAR RACKS
Stahl Gear & Mch. Co., The, 3901 Hamilton Ave., Cleveland 4, Ohio.

GEAR SHAPERS
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Fellows Gear Shaper Co., Springfield, Vt.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.

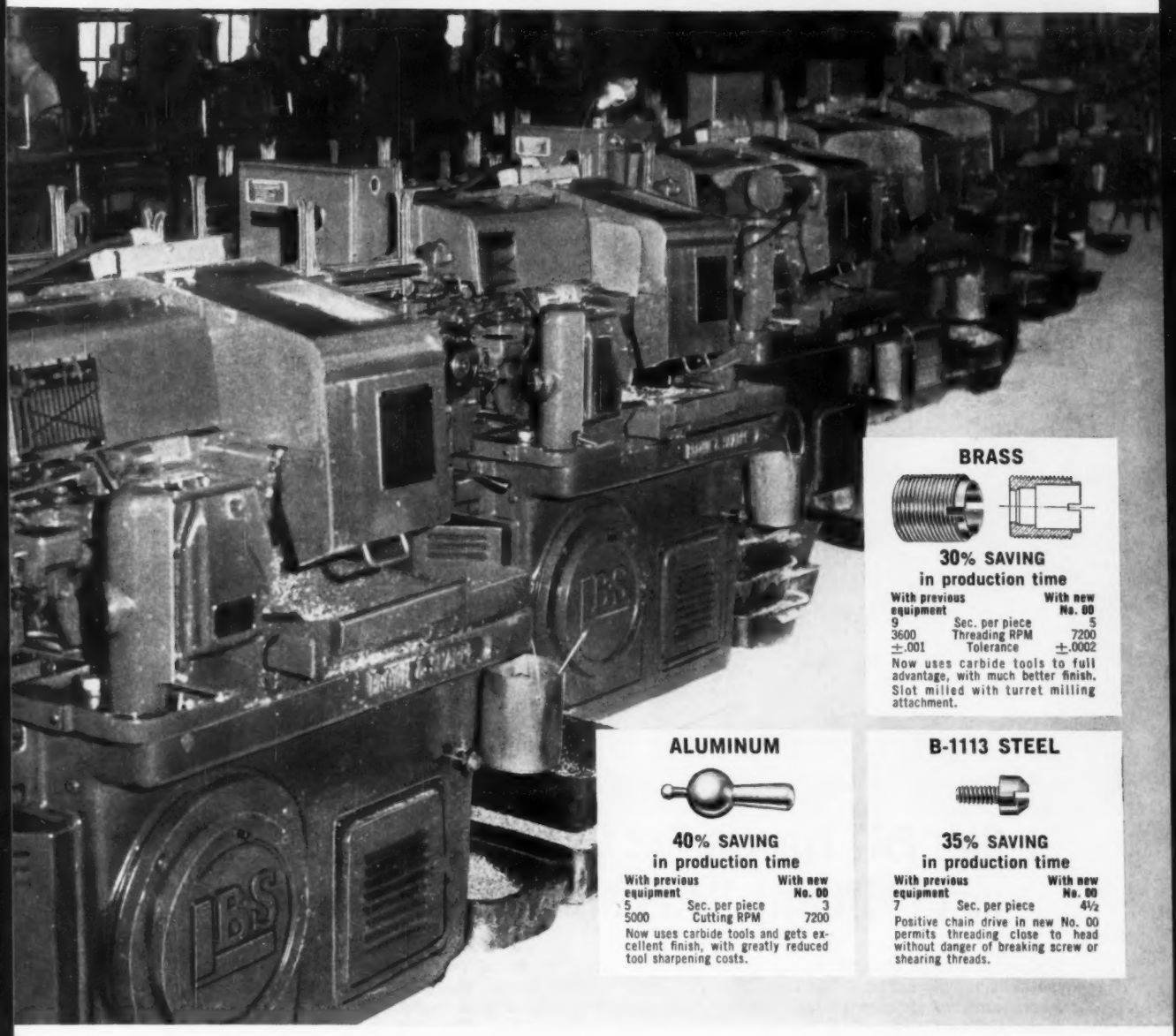
GEAR SHAVERS
Fellows Gear Shaper Co., Springfield, Vt.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.

GEARS, AND GEAR BLANKS, Nonmetallic
Boston Gear Works, 14 Hayward St., Quincy 71, Mass.
Cincinnati Gear Co., Wooster Pike and Mariemont Ave., Cincinnati, Ohio.
Diefendorf Gear Corp., Box 934, Syracuse, N. Y.
Greaves Machine Tool Co., 2011 Eastern Ave., Cincinnati, Ohio
New Jersey Gear & Mfg. Co., Hillside, N. J.
Ryerson, Jos. T. & Son, Inc., 16th and Rockwell St., Chicago 8, Ill.
Stahl Gear & Mch. Co., 3901 Hamilton Ave., Cleveland 14, Ohio

GEARS, Cut
Bilgram Gear & Mch. Works, 1217-35 Spring Garden St., Philadelphia, Pa.
Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa.
Boston Gear Works, 14 Hayward St., Quincy 71, Mass.
Cincinnati Gear Co., Wooster Pike and Mariemont Ave., Cincinnati, Ohio
Diefendorf Gear Corp., Box 934, Syracuse, N. Y.
Greaves Machine Tool Co., 2011 Eastern Ave., Cincinnati, Ohio.

(Continued on page 270)

At ARROW (AH) HART



BRASS

30% SAVING
in production time

With previous equipment		With new No. 00
9	Sec. per piece	5
3600	Threading RPM	7200
±.001	Tolerance	±.0002

Now uses carbide tools to full advantage, with much better finish. Slot milled with turret milling attachment.

ALUMINUM

40% SAVING
in production time

With previous equipment		With new No. 00
5	Sec. per piece	3
5000	Cutting RPM	7200

Now uses carbide tools and gets excellent finish, with greatly reduced tool sharpening costs.

B-1113 STEEL

35% SAVING
in production time

With previous equipment		With new No. 00
7	Sec. per piece	4½

Positive chain drive in new No. 00 permits threading close to head without danger of breaking screw or shearing threads.

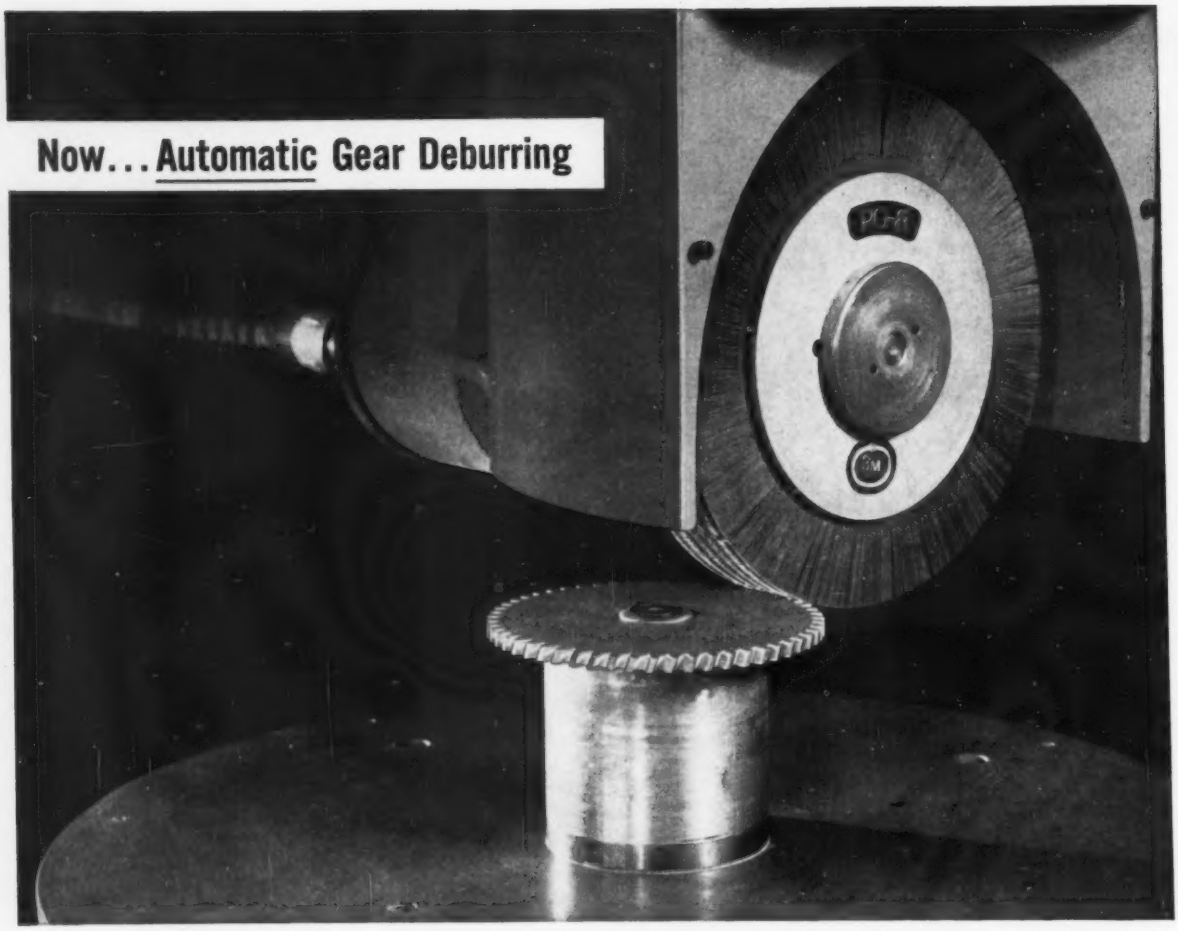
Production gains average 35%
with new Brown & Sharpe Automatics

Arrow-Hart and Hegeman Co. depends on screw machines for an exceptional volume and variety of parts used in their big line of electrical products. Production efficiency of this department is a vital factor in cost control. That is why nineteen new Brown & Sharpe No. 00 and No. 2 automatics are now in operation, and more are being installed as old model machines are replaced.

The parts described are typical of hundreds of jobs now running on the new No. 00 automatics. Production gains on brass, steel, and aluminum average 35%, and on some jobs where second operations were eliminated, net production was increased as much as 100%.

Figure the comparable savings you can make with the extra speed and precision — the adaptability for combined operations — the faster set-ups and extended tool life. You'll see why so many buyers say, *"They pay for themselves, in record time."* For complete details, write: Machine Tool Division, Brown & Sharpe Mfg. Co., Providence 1, R. I.

Brown & Sharpe PRECISION CENTER



3M "PG" Wheels Cut Gear Deburring Costs up to 75% with New Barber-Colman Deburrer

Spur or helical gears and sprockets can be deburred automatically, rapidly and economically by this new Coated Abrasive method. Developed through joint effort between Barber-Colman Company and 3M Company, this method eliminates the costly hand operations—filing, grinding, wire-brushing—and expensively slow machine operations previously required for precision deburring.

The heart of the method is the versatile 3M "PG" Wheel. As shown, the abrasive leaves of the "PG" Wheel conform to the *exact* shape required to deburr either spur or helical gears. On-the-line tests of this 3M—Barber-Colman team have shown unit cost reductions of 75% and more on a variety of gears.

Write us today for complete information on this new method and machine and for 3M technical assistance on any grinding and finishing operation in your plant. See how the right abrasive can cut your costs and widen your profit margin. Address your request to 3M Company, Department TV-69, St. Paul 6, Minnesota. No obligation, of course.

"PG" Wheels are manufactured in U.S.A. by 3M Company, St. Paul 6, Minn. Export: 99 Park Avenue, New York. Canada: London, Ontario

WE RECOMMEND
How to use coated abrasives to cut costs . . . improve production, shown in the new 426 page book
COATED ABRASIVES
MODERN TOOL OF INDUSTRY
At bookstores or McGraw-Hill, N. Y.

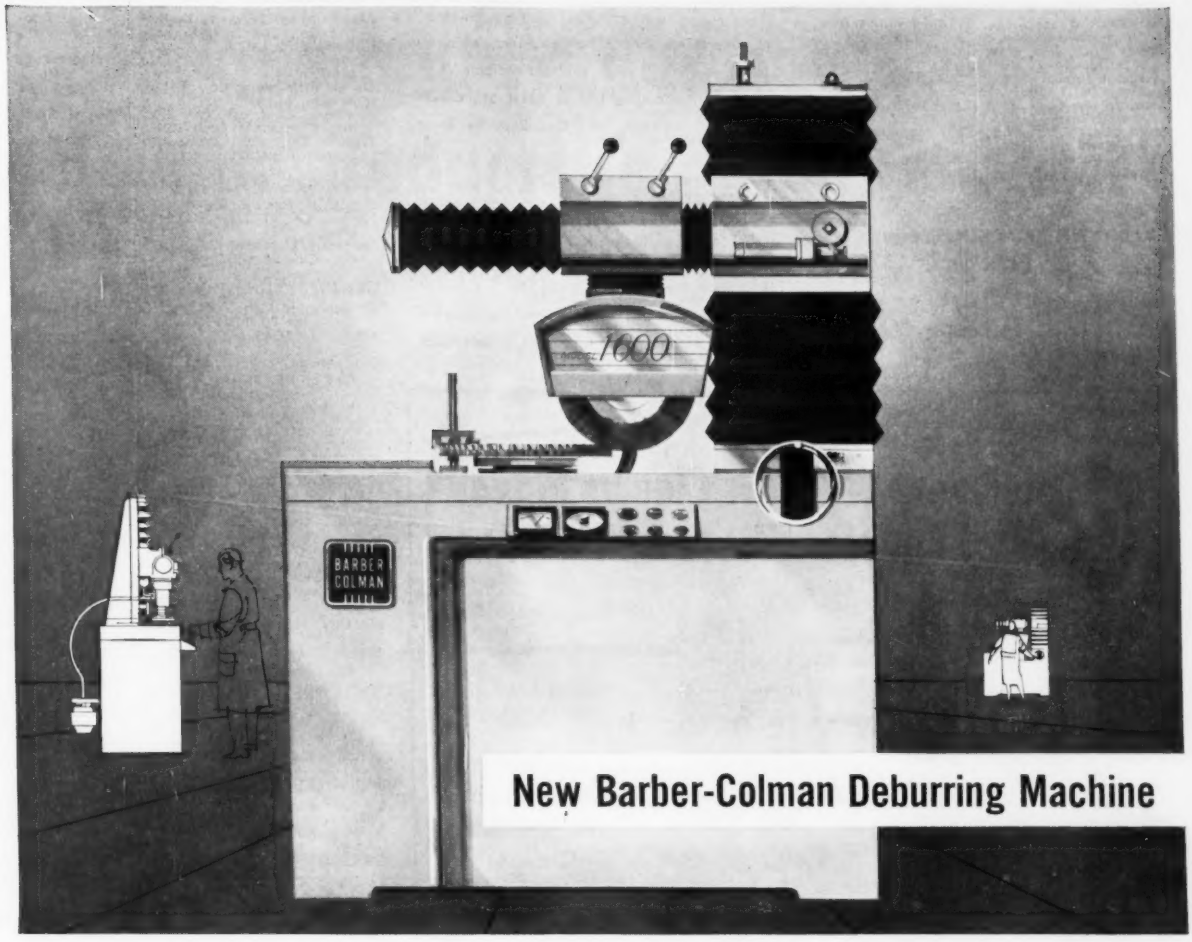
3M Coated Abrasives

"PG" WHEELS

MINNESOTA MINING AND MANUFACTURING COMPANY

. . . WHERE RESEARCH IS THE KEY TO TOMORROW

3M COMPANY



Fast, Efficient Gear Deburring

Deburring of spur and helical gears and sprockets is now fast, easy, and accurately controlled using a 3M "PG" wheel on the Barber-Colman Deburring Machine. This new method, developed by 3M Company and Barber-Colman Company, does not leave a burr on either the tooth profiles or the face of the gear. Also, it can grind a small chamfer on the complete tooth profile when required. Gears up to 16" diameter can be deburred on the Model 1600 machine. For fine-pitch gears, a smaller machine using a 6" PG wheel will be available. The same process also can be applied to deburring of gears larger than 16" diameter.

This versatile machine is designed specifically for the deburring of gears and other toothed forms using the "PG" wheel. It is automatic cycling, and most gears can be deburred in a matter of a few seconds. The formed wheel, which is dressed easily on the machine, rotates in timed relationship with the work. After the first dressing, wheels require no further maintenance. The wheel is fed automatically into the work a predetermined amount during each cycle and is engaged with the work for a predetermined length of time. After the initial setup, the operator just loads and unloads the machine.

For further information, contact your nearest Barber-Colman representative or the factory. We will be glad to arrange a demonstration showing how this machine will deburr your parts.

Barber-Colman Company

BARBER COLMAN

62 Loomis Street, Rockford, Illinois

For more data, circle this page number on inquiry card

Horsburgh & Scott Co., 5114 Hamilton Ave., Cleveland 14, Ohio
James D. O., Gear Mfg. Co., 1140 W. Monroe St., Chicago 7, Ill.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.
New Jersey Gear Mfg. Co., 1470 Chestnut Ave., Hillside, N. J.
Stahl Gear & Mch. Co., 3901 Hamilton Ave., Cleveland 14, Ohio
Verson Allsteel Press Co., 93rd St., & S. Kenwood Ave., Chicago, Ill.

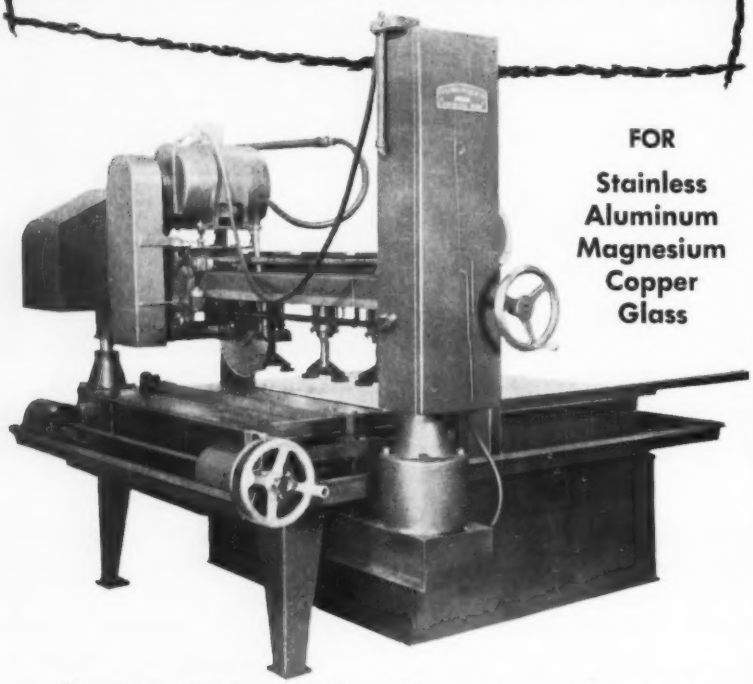
GRADUATING MACHINES
Gorton Geo., Mch. Co., 1321 Racine St., Racine, Wis.

GREASES—See Lubricating Oils and Greases

GRINDERS, Bench, Floor and Snag
Hammond Machinery Builders, Inc., Kalamazoo, Mich.
Jones & Lamson Mch. Co., Springfield, Vt.
Mummert-Dixon Co., Hanover, Pa.
National Acme Co., 170 E. 131st St., Cleveland 8, Ohio
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio

GRINDERS, Carbide Tool
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
DoAll Co., Des Plaines, Ill.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Hammond Machinery Builders, Inc., Kalamazoo, Mich.
Heald Machine Co., 10 New Bond St., Worcester 6, Mass.
Le Maire Machine Tool Co., 2657 S. Telegraph Rd., Dearborn, Mich.

Precision Saw With Air Clamps Makes Clean Cuts..Reduces Waste & Machining



FOR
Stainless
Aluminum
Magnesium
Copper
Glass

Rough edges left from shearing and inaccurate saws pile up needless machining bills . . . plus the cost of wasted metal. With this new Ty-Sa-Man 144-BD Saw, adjustable air clamps hold metal down while the saw travels down the machined transverse rail, delivering cuts with smooth edges to amazing tolerances. Cut parallel strips . . . handle difficult jig fixture work with this self-contained saw which has its own integral cooling system and tank. Among its features are a calibrated guide fence, infinite variable speed from zero to twenty FPM, push-button control and 15 HP motor.

Ty-Sa-Man
SINCE 1885

Write for FREE BROCHURE
TY-SA-MAN Machine Co., Inc.
1093 White Ave., Knoxville, Tenn.

Metallurgical Products Dept. of General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Norton Co., 1 New Bond St., Worcester 6, Mass.
Oliver Instrument Co., 1410 E. Maumee St., Adrian, Mich.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio
Wesson Co., 1220 Woodward Heights Blvd., Detroit 20, Mich.

GRINDERS, Die and Mold
DoAll Co., Des Plaines, Ill.
Norton Co., 1 New Bond St., Worcester 6, Mass.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio

GRINDERS, Drill Point
Consolidated Mch. Tool Div., 565 Blossom Rd., Rochester 10, N. Y.
Hammond Machinery Builders, Inc., Kalamazoo, Mich.
Oliver Instrument Co., 1410 E. Maumee, Adrian, Mich. (also drill point thinner)
Orban Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Standard Electrical Tool Co., 2500 River Rd., Cincinnati 4, Ohio.

GRINDERS, Face Mill
Kearney & Trecker Corp., 6784 W. National, Milwaukee 14, Wis.
Mattison Machine Works, 545 Blackhawk Park Ave., Rockford, Ill.
Oliver Instrument Co., 1410 E. Maumee St., Adrian, Mich.

GRINDERS, Knife and Shear
Hill Acme Co., 1201 W. 65th St. Cleveland 2, Ohio
Mattison Machine Works, Rockford, Ill.
Mummert-Dixon Co., Hanover, Pa.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio

GRINDERS, Portable Electric
Chicago Pneumatic Tool Co., New York 17, N. Y.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati 4, Ohio

GRINDERS, Portable Pneumatic
Chicago Pneumatic Tool Co., New York 17, N. Y.
Madison-Kipp Corp., Madison, Wis.

GRINDERS, Tap
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Hammond Machinery Builders, Inc., Kalamazoo, Mich.
Jones & Lamson Mch. Co., 160 Clinton St., Springfield, Vt.

GRINDERS, Tool and Cutter
Barber-Colman Co., 1300 Rock St., Rockford, Ill.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling and Grinding Mchs., Cincinnati 9, Ohio
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Fellows Gear Shaper Co., 78 River St., Springfield, Vt.
Gallmeyer & Livingston Co., 336 Straight Ave., S. W., Grand Rapids 4, Mich.
Gleason Works, 1000 University Ave., Rochester 3, N. Y.
Gorton, Geo., Mch. Co., 1321 Racine St., Racine, Wis.
Landis Tool Co., Waynesboro, Pa.
LeBlond, R. K., Mch. Tool Co. Madison and Edwards Rds., Cincinnati 18, Ohio
Mummert-Dixon Co., Hanover, Pa.
National Acme Co., 170 E. 131st St., Cleveland 8, Ohio
Norton Co., 1 New Bond St., Worcester 6, Mass.
Oliver Instrument Co., 1410 E. Maumee St., Adrian, Mich.
Orban, Kurt Co., Inc., 42 Exchange Place Jersey City 2, N. J.
Thompson Grinder Co., 1500 W. Main St., Springfield, Ohio

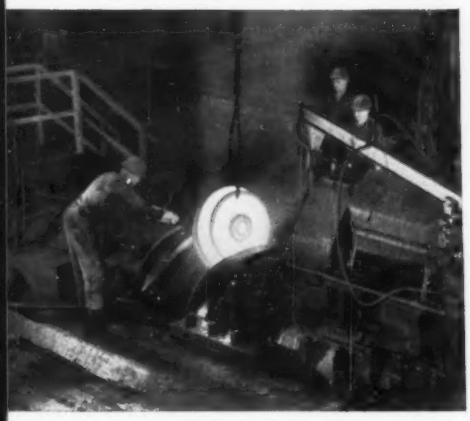
GRINDERS, Toolpost
Cosa Corp., 305 Lexington Ave., New York 17, N. Y.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio

GRINDING GAGES—See Gages, Grinding

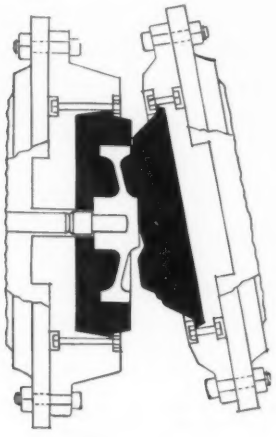
GRINDING MACHINES, Abrasive Belt
Hammond Machinery Builders, Inc., Kalamazoo, Mich.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio
Mattison Mch. Works, Rockford, Ill.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio

Unique Mill Forges and Rolls circular products in one operation

In less than one minute, this Bethlehem mill—the only one of its kind in the country —turns out a top-quality impression-die steel forging at a cost that's hard to match.



This is Bethlehem's famed circular-products mill—the Slick Mill. Named for its designer, Edwin E. Slick, this unique machine produces impression-die circular forgings ranging from 10 in. to 46 in. OD; as-rolled weights ranging from 100 to 2,000 lb. It handles almost any grade of steel—carbon, alloy or stainless, as well as certain heat-resistant grades.

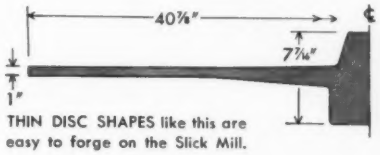


How It Works

Designed to operate in a horizontal plane, Bethlehem's Slick Mill is constructed with two *revolvable* spindles on which face plates are mounted. These face plates support the impression dies that form the steel billet into shape by a combination press and rolling action.

After the steel billet is heated and descaled, it is centered between the dies of the Slick Mill. Then a 1500-ton hydraulic ram actuates the spindle on the straight side of the mill, upset forging the billet. When this cycle is completed, a 2,000-hp motor actuates the spindle on the angle side of the mill and the rolling cycle begins. By continuing the upsetting action and rotation of the dies and work, the material flows into the recesses of the dies, resulting in the desired shape. *The entire rolling cycle takes about one minute.*

After rolling, excess material in the form of flash is sheared off; the hub, when necessary, is punched; and the forging is inspected.



THIN DISC SHAPES like this are easy to forge on the Slick Mill.

Cost-Saving Features

Quick operation: Only one minute is needed to convert a heated slug into a contoured forging, whether the product weighs 100 or 2,000 lb.

Quick die changes: Only 15 minutes are needed to change and set up dies. Even production runs as small as 25 or 50 pieces are economical.

Low die charges: Since contact time between die and work is very brief, and because there is no impacting, low-cost die blocks can be used. In many cases, die charges are ⅓ to ½ less than conventional impression dies.

Less steel needed: Utilizing the principle of forging design, the Slick Mill can produce lighter-weight sections without sacrificing strength.

Good physical characteristics: The process insures excellent grain flow, machinability and soundness.

Bethlehem's Slick Mill is readily adapted to jobbing or production quantities of forged circular products such as: gear blanks, fly wheels; crane track wheels; sheave wheels; brake drums; clutch discs; couplings; tire moulds; and turbine or compressor wheels. Products may be specified as-rolled or rough machined to specifications.

Your inquiry—whatever the quantity involved—will receive prompt attention. Call or write the Bethlehem sales office nearest you today.

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation. *Export Distributor:* Bethlehem Steel Export Corporation

BETHLEHEM STEEL

BETHLEHEM STEEL

GRINDING MACHINES, Broach

Gallmeyer & Livingston Co., 336 Straight, S. W. Grand Rapids 2, Mich.
National Broach & Mch. Co., 5600 St. Jean, Detroit 13, Mich.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Thompson Grinder, 1534 W. Main, Springfield, Ohio

GRINDING MACHINES, Cam

Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Landis Tool Co., Waynesboro, Pa.
Norton Co., 1 New Bond St., Worcester 6, Mass.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Van Norman Machine Co., 3640 Main St., Springfield 7, Mass.

GRINDING MACHINES, Centerless

Cincinnati Milling and Grinding Mchs., Inc., Cincinnati 9, Ohio
Heald Machine Co., 10 New Bond St., Worcester 6, Mass.
Landis Tool Co., Waynesboro, Pa.
Van Norman Machine Co., 3640 Main St., Springfield 7, Mass.

GRINDING MACHINES, Crankshaft

Landis Tool Co., Waynesboro, Pa.
Norton Co., 1 New Bond St., Worcester 6, Mass.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Van Norman Machine Co., 3640 Main St., Springfield 7, Mass.

GRINDING MACHINES, Cylindrical

Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling and Grinding Mchs., Inc., Cincinnati 9, Ohio
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Gallmeyer & Livingston Co., 336 Straight, S. W., Grand Rapids 2, Mich.
Hammond Machinery Builders, Inc., Kalamazoo, Mich.
Landis Tool Co., Inc., Waynesboro, Pa.
Norton Co., 1 New Bond St., Worcester 6, Mass.
Sheffield Corp., Box 893, Dayton 1, Ohio
Standard Electrical Tool Co., 2500 River Rd., Cincinnati 4, Ohio
Van Norman Machine Co., 3640 Main St., Springfield 7, Mass.

GRINDING MACHINES, Disc

Brown & Sharpe Mfg., Co., Providence, R. I.
Gardner Machine Co., Beloit, Wis.
Mattison Machine Co., Beloit, Wis.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio

GRINDING MACHINES, Gear

Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Fellows Gear Shaper Co., Springfield, Vt.
Gear Grinding Machine Co., 3901 Christopher St., Detroit 11, Mich.
Gleason Works, 1000 University Ave., Rochester 3, N. Y.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Sheffield Corp., Box 893, Dayton 1, Ohio

GRINDING MACHINES, Internal

Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Gallmeyer & Livingston Co., 336 Straight, S. W. Grand Rapids 2, Mich.
Heald Machine Co., 10 New Bond St., Worcester 6, Mass.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Standard Electrical Tool Co. 2488-90 River Rd., Cincinnati, Ohio
Van Norman Machine Co., 3640 Main St., Springfield 7, Mass.
Wicaco Machine Corp., Wayne Junction, Philadelphia, Pa.

GRINDING MACHINES, Jig

Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Fosdick Mch. Tool Co., 1638 Blue Rock St., Cincinnati 23, Ohio
Gallmeyer & Livingston Co., 336 Straight S. W., Grand Rapids 2, Mich.
Moore Special Tool Co., Inc., 740 Union Ave., Bridgeport, Conn.

GRINDING MACHINES, Profile

American Laubscher Corp., Fisk Bldg., 250 W. 57 St., New York 19, N. Y.
Baker Brothers Inc., 1000 Post Ave., Toledo 10, Ohio
Cincinnati Milling and Grinding Mchs., Inc., Cincinnati 9, Ohio
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
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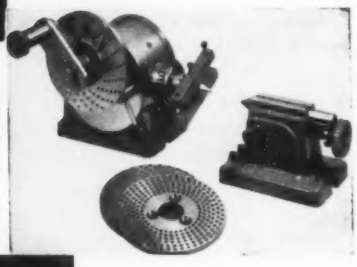

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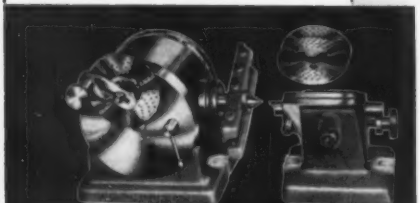

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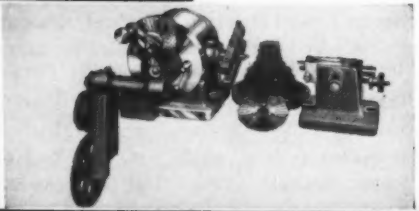

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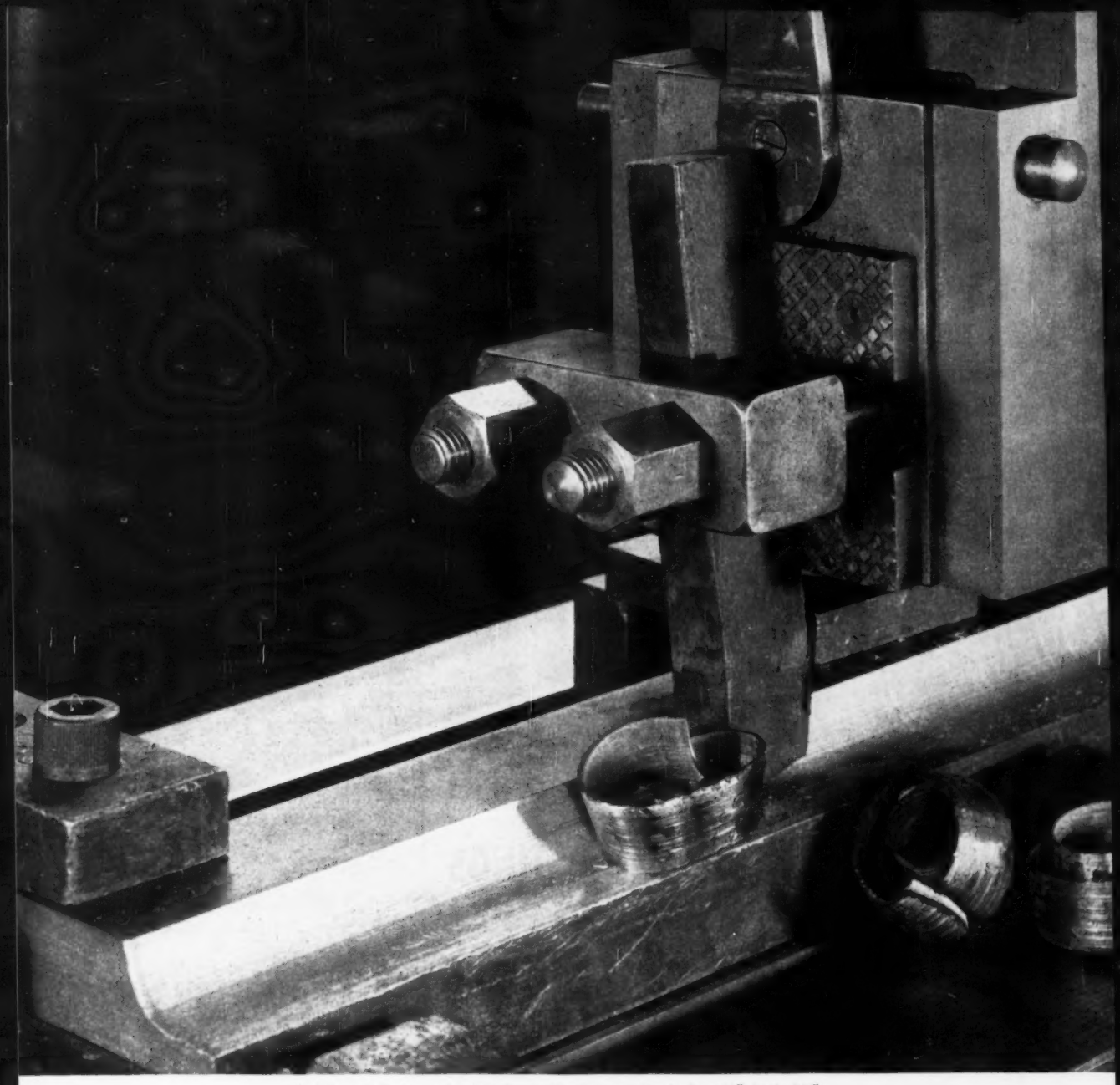

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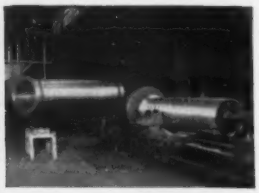

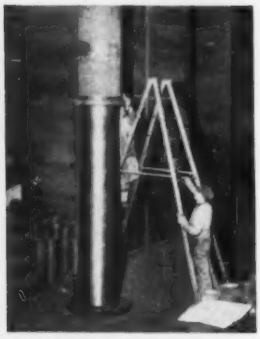

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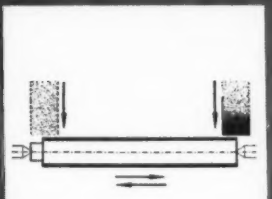

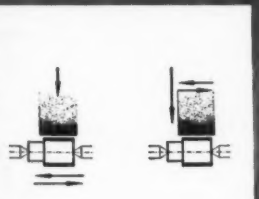

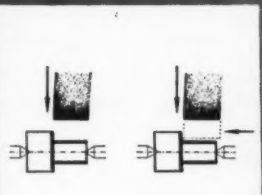

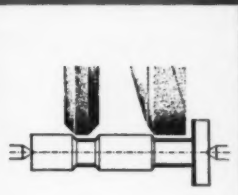

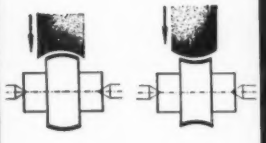

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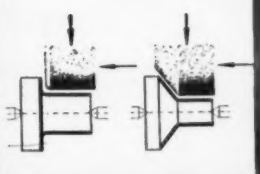

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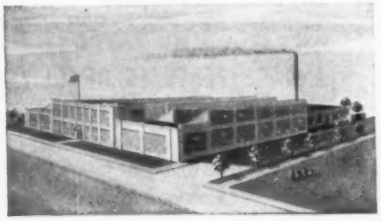

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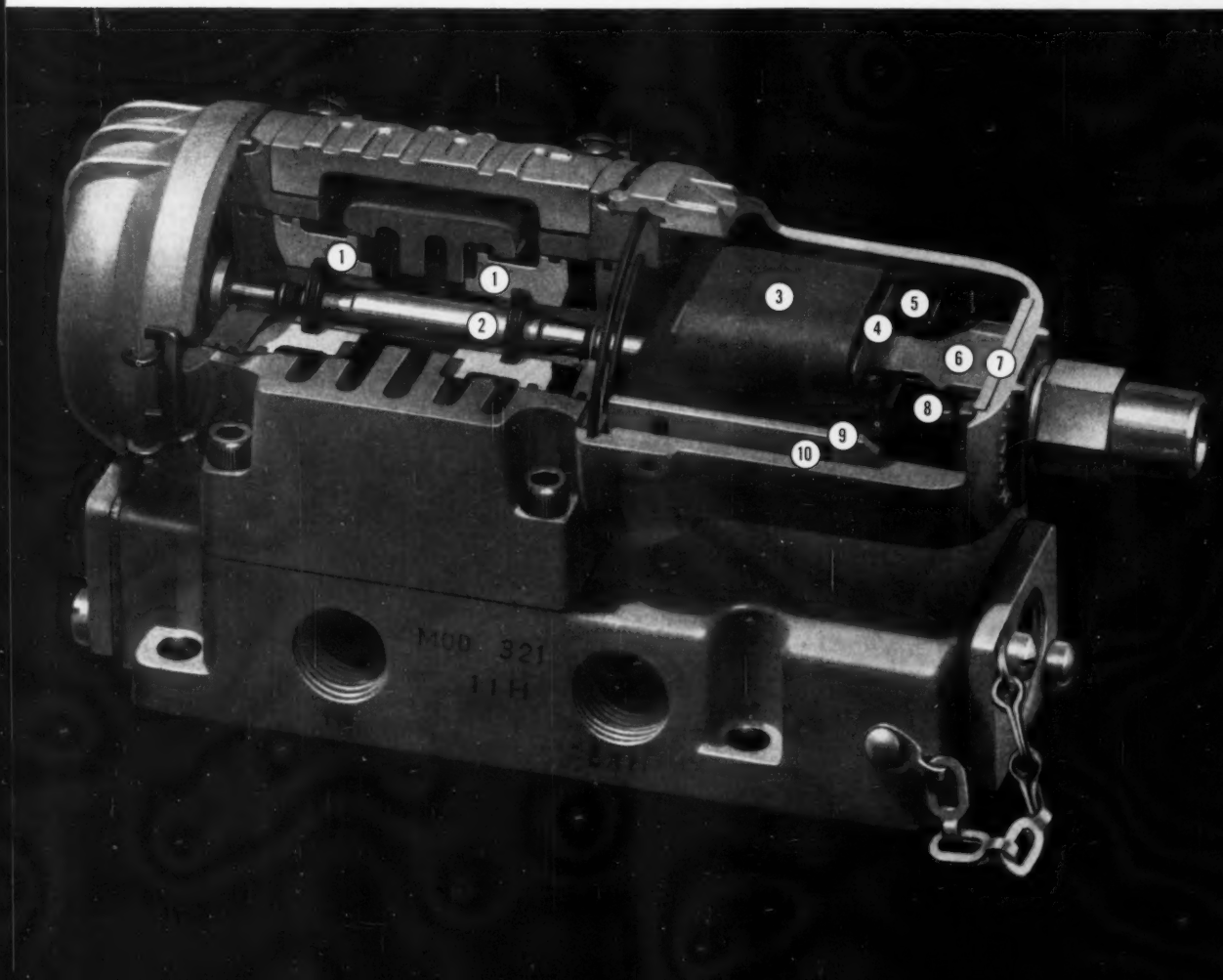

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LATHE ATTACHMENTS

Clearing Div., of U. S. Industries, Inc., 6499 W. 65th St., Chicago 38, Ill.
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.
Hardinge Bros., Inc., 1420 College Ave., Elmira, N. Y.
Jones & Lamson Mch. Co., 512 Clinton St., Springfield, Vt.
LeBlond, R. K., Mch. Tool Co:. Madison and Edwards Rds., Cincinnati 18, Ohio
Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25, Ohio
Nebel Machine Tool Corp., 3401 Central Pkwy., Cincinnati 25, Ohio.
Sheldon Mch. Co., Inc., 4258 N. Knox Ave., Chicago 41, Ill.
Sidney Mch. Tool Co., Sidney, Ohio
Williams, J. H. & Co, 400 Vulcan St., Buffalo 7, N. Y.

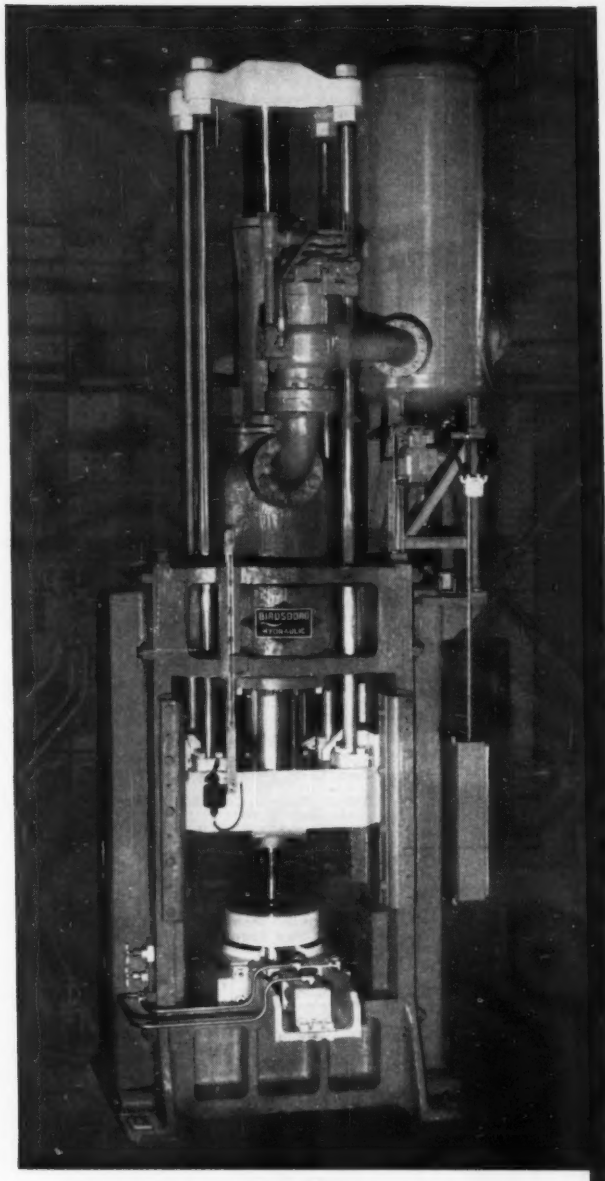
LATHES, AUTOMATIC—See Chucking Machines

LATHES, Axle

Consolidated Mch. Tool Div., Farrel-Birmingham Co., Inc., Rochester 10, N. Y.
Hamilton Div., Baldwin-Lima-Hamilton Corp. Hamilton, Ohio
Monarch Mch. Tool Co., Oak St., Sidney, Ohio
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

LATHES, Bench

Hardinge Bros., Inc., 1420 College Ave., Elmira, N. Y.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio
Sheldon Mch. Co., Inc., 4240-4258 N. Knox Ave., Chicago 41, Ill.



forging/extruding research press by **BIRDSBORO**

• This 500-ton combination forging and extruding oil-hydraulic press is designed to help a leading steel producer study the behavior of new metals in its research center. The unusual flexibility of the press design makes it ideal for experimental work. All operations can be performed under manual or automatic control. Though many of the metals studied are unpredictable, one thing is certain . . . top performance from the Birdsboro press. You can learn more of the reasons why from your nearest Birdsboro representative, or: *Sales Department:* **Reading, Pa.,** *Engineering Department and Plant:* **Birdsboro, Pa.,** *District Office:* **Pittsburgh, Pa.**

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PERFORMANCE DATA:

- *Forging—Over fifty 1" strokes per minute on planishing cycle*
- *Extrusion—15" to 150" per minute speed remotely controlled*
- *Interlocked hydraulic-electric circuit provides unusual flexibility*
- *Selector switch permits rapid operating changeover*
- *Designed for manual and semi-automatic forging and manual planishing*
- *Extruding is arranged for automatic sequence operation. Shear is built into tooling.*
- *Press can be utilized for production*

BIRDSBORO HYDRAULIC

For more data, circle this page number on inquiry card

LATHES, Car Wheel
Bullard Co., Bridgeport 6, Conn.
Consolidated Mch. Tool Div., Blossom Road, Rochester 10, N. Y.
Hamilton Div., Baldwin-Lima-Hamilton Corp., Hamilton, Ohio

LATHES, Copying, Duplicating — See Lathes, Duplicating

LATHES, Crankshaft
Consolidated Mch. Tool Corp., Rochester, N. Y.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds, Cincinnati 18, Ohio
Snyder Tool & Engrg. Co., 3400 E. Lafayette Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

LATHES, Double-End
Cleveland Automatic Machine Co., 4932 Beech St., Cincinnati 12, Ohio
Consolidated Mch. Tool Corp., Rochester, N. Y.
LeBlond, R. K., Mch. Tool Co, Madison and Edwards Rds., Cincinnati 18, Ohio
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2351 11th St., Rockford, Ill.

LATHES, Duplicating
Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25, Ohio
Monarch Machine Tool Co., 27 Oak St., Sidney Ohio
Sidney Machine Tool Co., Highland Ave. Sidney, Ohio

LATHES, Engine, Manufacturing
American Tool Works Co., Pearl and Eggleston Aves., Cincinnati, Ohio
Cincinnati Lathe & Tool Co., 3207 Disney St., Cincinnati 9, Ohio
Clearing Div., of U. S. Industries, Inc., 6499 W. 65th St., Chicago 38, Ill.
Consolidated Mch. Tool Div, Blossom Road. Rochester 10. N. Y.
Hendey Mch. Div., Barber Colman Co., Rockford, Ill.
Homestrand, Inc., Larchmont, N. Y.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio
Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25, Ohio
Nebel Machine Tool Corp., 3401 Central Pkwy., Cincinnati 25, Ohio.
Orban, Kurt Co., Inc., 42 Exchange Place. Jersey City 2, N. J.
Rockford Machine Tool Co., 2500 Kishwaukee St., Rockford, Ill.
Sheldon Mch. Co., Inc., 4240-4258 N. Knox Ave., Chicago 41, Ill.
Sidney Mch. Tool Co., Sidney, Ohio

LATHES, Engine, Toolroom
American Tool Works Co., Pearl and Eggleston Aves., Cincinnati, Ohio
Cincinnati Lathe & Tool Co., 3207 Disney St., Cincinnati 9, Ohio
Clearing Div., of U. S. Industries, Inc., 6499 W. 65th St., Chicago 38, Ill.
Hardinge Bros. Inc., 1420 College Ave., Elmira, N. Y.
Hendey Mch. Div., Barber Colman Co., Rockford, Ill.
Homestrand, Inc., Larchmont, N. Y.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio
Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25, Ohio
Logan Engineering Co., 4901 Lawrence Ave., Chicago 30, Ill.
Monarch Machine Tool Co., 27 Oak St., Sidney, Ohio
Nebel Machine Tool Corp., 3401 Central Pkwy., Cincinnati 25, Ohio.
Orban, Kurt Co., Inc., 42 Exchange Place Jersey City 2, N. J.
Rockford Machine Tool Co., 2500 Kishwaukee St., Rockford, Ill.
Sheldon Mch. Co., Inc., 4240-4258 N. Knox Ave., Chicago 41, Ill.
Sidney Mch. Tool Co., Sidney, Ohio

LATHES, Gap
Cincinnati Lathe & Tool Co., 3207 Disney St. Cincinnati 9, Ohio
Clearing Div., of U. S. Industries, Inc., 6499 W. 65th St., Chicago 38, Ill.
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio
Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25, Ohio
Nebel Machine Tool Corp., 3401 Central Pkwy., Cincinnati 25, Ohio.
Sidney Machine Tool Co., Highland Ave. Sidney, Ohio

LATHES, Hollow Spindle
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio
Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25, Ohio
South Bend Lathe Works Inc., 425 E. Madison St., South Bend Ind.

LATHES, Roll
American Tool Works Co., Pearl and Eggleston Aves., Cincinnati 2, Ohio
Bliss, E. W., Co., Canton, Ohio
Hamilton Div., Baldwin-Lima-Hamilton Corp., Hamilton, Ohio
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio
Monarch Mch. Tool Co., Oak St., Sidney, Ohio
Orban, Kurt Co., Inc., 42 Exchange Place. Jersey City 2, N. J.

LATHES, Speed, Second-operation
Gisholt Machine Co, 1245 E Washington Ave., Madison 10, Wis.
Hardinge Bros., Inc., 1420 College Ave., Elmira, N. Y.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio
Monarch Mch. Tool Co., Oak St., Sidney, Ohio
Orban, Kurt Co., Inc., 42 Exchange Place. Jersey City 2, N. J.
Sheldon Mch. Co., 4258 N. Knox Ave., Chicago 41, Ill.
Standard Electrical Tool Co., 2500 River Rd., Cincinnati 4, Ohio

LATHES, Spinning
Cincinnati Milling & Grinding Mches., Inc., 4701 Marburg Ave., Cincinnati 9, Ohio
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Lodge & Shipley Co., The, Cincinnati 25, Ohio
Orban, Kurt Co., Inc., 42 Exchange Place. Jersey City 2, N. J.

LATHES, Toolroom—See Lathes, Engine, Toolroom

LATHES, Turret, Automatic
Bullard Co., Bridgeport 2, Conn.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis
Jones & Lamson Mch. Co., 512 Clinton St., Springfield, Vt.
King Machine Tool Div., American Steel Foundries, 1150 Tennessee Ave., Cincinnati 29, Ohio
National Acme Co., 170 E. 131st St., Cleveland 3, Ohio
New Britain Mch. Co., New Britain-Gridley Dive., New Britain, Conn.

LATHES, Turret, Ram Type Saddle Type
Bardons & Oliver, Inc., 1133 W. Ninth St., Cleveland 13, Ohio
Bullard Co., Bridgeport 2, Conn.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.
Hardinge Brothers, Inc., 1420 College Ave., Elmira, N. Y.
Jones & Lamson Mch. Co., 512 Clinton St., Springfield, Vt.
New Britain Mch. Co., New Britain-Gridley Div., New Britain, Conn.
Sheldon Mach. Co., Inc., 4258 N Knox Ave., Chicago 41, Ill.
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 3, Ohio

LATHES, Turret, Vertical—See Boring Mills, Vertical

LAYOUT and DRAFTING TOOLS
Brown & Sharpe Mfg. Co., 235 Promenade St., Providence 1, R. I.
Starrett, L. S., Co., Athol, Mass.

LEAD SCREWS & SPLINES, Ball Bearing
Saginaw Steering Gear Div., General Motors Corp., Saginaw Mich.

LEVELS
Starrett, The L. S. Co., Athol, Mass.

LIMIT SWITCHES—See Switches, Limit

LUBRICATING OILS and GREASES
Cities Service Oil Co., 70 Pine St., New York, N. Y.
Houghton, E. F. & Co., 303 W. Lehigh Ave., Philadelphia 33, Penna.

(Continued on page 284)

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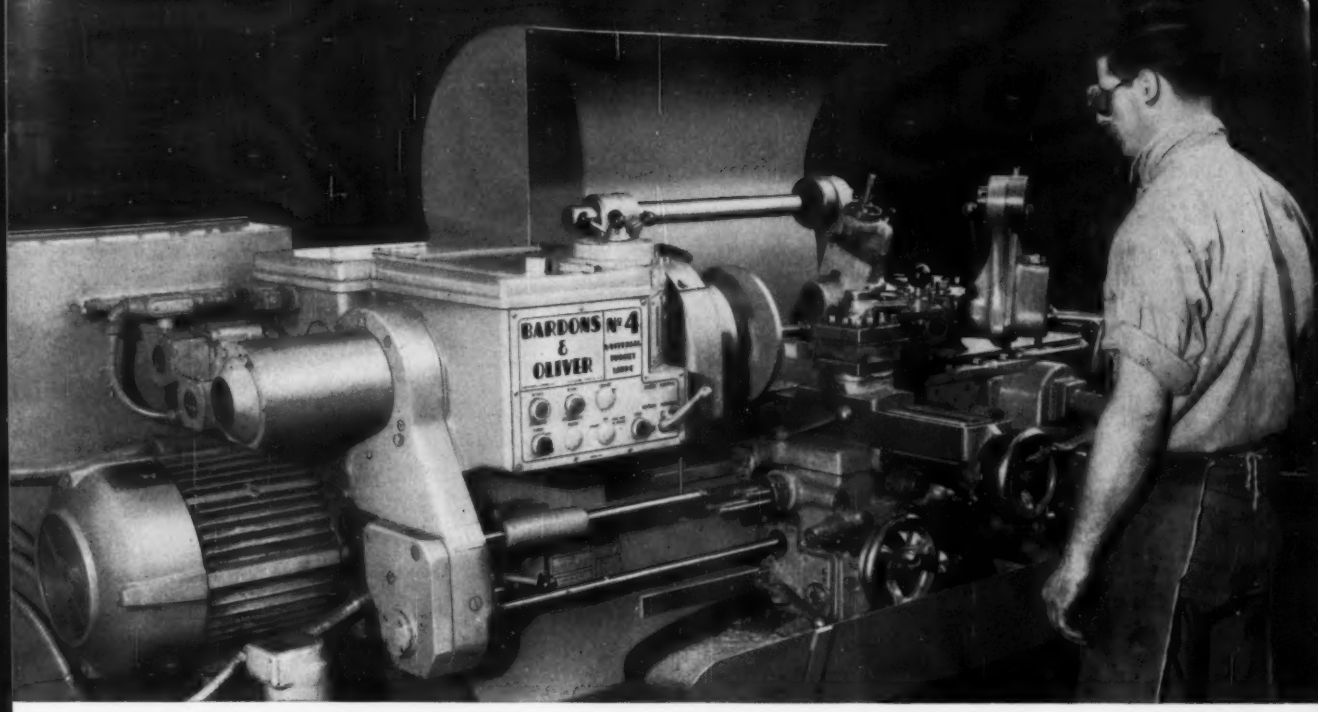


BARDONS & OLIVER NO. 4 TURRET LATHE

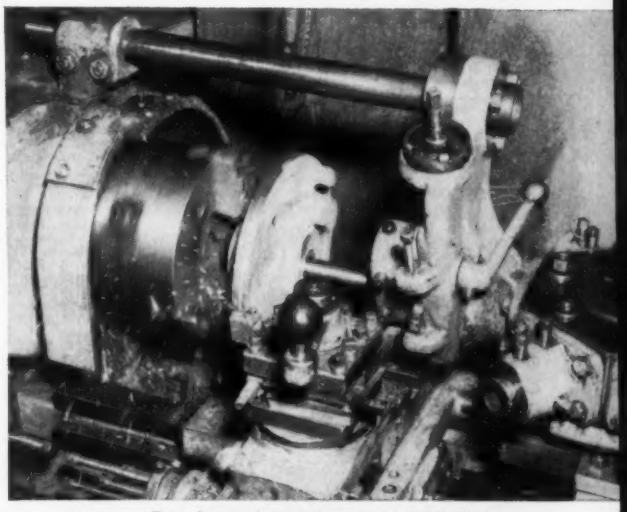
"Biggest Money-Maker in the Plant"

Reports W. W. McCain, Jr., Factory Manager, Chicago Machinery Laboratory, Inc. This progressive firm manufactures automatic signature feeders and magazine trimmers. Mr. McCain further states:

"The addition of the No. 4 Bardons & Oliver has allowed us to reduce direct labor in the turret lathe department, and at the same time increase output by 50%. Over 600 different parts are made on the machine. Extreme accuracy of the No. 4 allows us to hold bearing diameters within ±.00025"; at the same time high spindle speeds, heavy feeds, and combined and multiple cuts allow full utilization of the 15 HP main drive motor. The machine is very convenient to setup and operate. During two years of 100 hours a week operation, downtime on the No. 4 has been negligible.

We feel that the Bardons & Oliver No. 4 is the most compact and efficient turret lathe available having 18" swing over the bedways. By making a totally different turret lathe for each range of work, Bardons & Oliver offers just the right size machine for any job."

Your Bardons & Oliver representative will welcome the opportunity to discuss with you the profit possibilities offered by these turret lathes.



Rough turning & boring 11-1/2" O. D. cast iron cam follower wheel.

BARDONS & OLIVER

BARDONS & OLIVER, INC., 1133 WEST 9th ST., CLEVELAND 13, OHIO

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Shell Oil Co., 50 W. 50th St., New York, N. Y.
Standard Oil Co. (Indiana), 910 S Michigan, Chicago, Ill.
Texaco, Inc., 135 E. 42nd St. New York 17, N. Y.

LUBRICATING SYSTEMS

Gits Bros. Mfg. Co., 1846 S. Kilbourn Ave., Chicago 23, Ill.
Madison-Kipp Corp., Madison, Wis.

MACHINERY, Used and Rebuilt

Eastern Mchry. Co., 1000 Tennessee Ave., Cincinnati, Ohio
Miles Mchry. Co., 2025 E. Genessee Ave., Saginaw, Mich.
Motch & Merryweather Mchy. Co., 888 E. 70th St., Cleveland 3, Ohio
Van Keuren Co., Watertown 72, Mass.

MACHINISTS' SMALL TOOLS

Brown & Sharpe Mfg. Co., 235 Promenade St., Providence 1, R. I.
DoALL Co., Des Plaines, Ill.
Niagara Mch. & Tool Wks., 637-697 Northland Ave., Buffalo 11, N. Y.
Starrett, The L. S., Co., Athol, Mass.
Van Keuren Co., 176 Waltham St., Watertown 72, Mass.
Williams, J. H & Co., 400 Vulcan St., Buffalo 7, N. Y.

MANDRELS—See Arbors and Mandrels

MARKING MACHINES and DEVICES

Gorton Mch. Co., 1321 Racine St., Racine, Wis.

MATERIAL-HANDLING TRUCKS—See Trucks, Material Handling

MEASURING MACHINES

Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Sheffield Corp., 721 Springfield St., Dayton, 1, Ohio
Van Keuren Co., 176 Waltham St., Watertown 72, Mass.

MEASURING WIRES—Thread, Spline, Gear

Sheffield Corp., Dayton 1, Ohio
Threadwell Tap & Die Co., 16 Arch St., Greenfield, Mass.
Van Keuren Co., 176 Waltham St., Watertown 72, Mass.

MICROMETER HEADS

Brown & Sharpe Mfg. Co., 235 Promenade St., Providence 1, R. I.
DoALL Co., Des Plaines, Ill.
Starrett, The L. S., Co., Athol, Mass.

MICROMETERS, Outside, Inside, Depth

Brown & Sharpe Mfg. Co., 235 Promenade St., Providence 1, R. I.
DoALL Co., Des Plaines, Ill.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Starrett, The L. S., Co., Athol, Mass.
Van Keuren Co., 176 Waltham St., Watertown 72, Mass.

MICROSCOPES, Toolmakers'

DoALL Co., Des Plaines, Ill.
Opto-Metric Tools, Inc., 137 Varick St., New York, N. Y.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.

MILLING MACHINE ATTACHMENTS

Bridgeport Mches., Inc., 500 Lindley St., Bridgeport 6, Conn.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling & Grinding Mches. Inc., 4701 Marburg Ave., Cincinnati 9, Ohio
Gorton, George Mch. Co., 1110 W. 13th St., Racine, Wis.
Greaves Mch. Tool Div., 2011 Eastern Ave., Cincinnati 2, Ohio
Hardinge Bros., Inc., 1420 College Ave., Elmira, N. Y.
Kearney & Trecker Corp., 6784 W. National, Milwaukee 14, Wis.
Nichols, W. H. Co., Waltham 54, Mass.
Sheldon Mch. Co., Inc., 4258 N Knox Ave., Chicago 41, Ill.
Van Norman Machine Co., 3640 Main St., Springfield 7, Mass.

MILLING MACHINES, Automatic

Buhr Machine Tool Co., 839 Greene St., Ann Arbor, Mich.
Cincinnati Milling Machine Co., Cincinnati, Ohio
Consolidated Machine Tool Corp., Rochester, N. Y.
Cross Co., 3250 Bellevue Ave., Detroit 7, Mich.
Ingersoll Milling Machine Co., 505 Fulton Ave., Rockford, Ill.
Jones & Lamson Mch. Co., 160 Clinton St., Springfield, Vt.
Lamb, F. Joseph Co., 5663 E. Nine Mile Rd., Detroit 34, Mich.
Nichols, W. H. Co., Waltham 54, Mass.
Olivetti Corp. of America, 42-33 Northern Blvd., Long Island City 1, N. Y.
Pratt & Whitney Co., Inc., West Hartford, Conn.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
U. S. Tool Co., Inc., 255 North 18th St., Ampere, E. Orange, N. J.

MILLING MACHINES, Bed Type, Simplex, Duplex

Brown & Sharpe Mfg. Co., 235 Promenade St., Providence 1, R. I.
Cincinnati Milling & Grinding Mches., Inc., 470 Marburg Ave., Cincinnati 9, Ohio
Consolidated Mch. Tool Div., Blossom Road, Rochester 10, N. Y.
Espen-Lucas Mch. Wrks., Front St., and Girard Ave., Philadelphia, Pa.
Ingersoll Milling Machine Co., 505 Fulton Ave., Rockford, Ill.
Kearney & Trecker Corp., 6784 W. National, Milwaukee 14, Wis.
Motch & Merryweather Mchy. Co., 888 E. 70th St., Cleveland 3, Ohio
Nichols, W. H. Co., Waltham 54, Mass.
Olivetti Corp. of America, 42-33 Northern Blvd., Long Island 1, N. Y.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
U. S. Tool Co., Inc., 255 North 18th St., Ampere, E. Orange, N. J.
Van Norman Machine Co., 3640 Main St., Springfield 7, Mass.

MILLING MACHINES, Bench, Hand

Hardinge Bros. Inc., 1420 College Ave., Elmira, N. Y.

MILLING MACHINES, Circular, Continuous

Consolidated Mch. Tool Corp., Rochester, N. Y.
Davis & Thompson Co., 6411 W. Burnham St., Milwaukee 14, Wis.
Espen Lucas Mch. Works, Front St. and Girard Ave., Philadelphia, Pa.
Ingersoll Milling Machine Co., 505 Fulton Ave., Rockford, Ill.
Nichols, W. H. Co., Waltham 54, Mass.
Olivetti Corp. of America, 42-33 Northern Blvd., Long Island City 1, N. Y.
Snyder Tool & Engrg. Co., 3400 E. Layfayette, Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2351 11th St., Rockford, Ill.

MILLING MACHINES, Die Sinking, Duplicating, Profiling

Bridgeport Mches., Inc., 500 Lindley St., Bridgeport 6, Conn.
Cincinnati Milling & Grinding Mches., Inc., 4701 Marburg Ave., Cincinnati 9, Ohio
Clearing Div., of U. S. Industries, Inc., 6499 W. 65th St., Chicago 38, Ill.
Consolidated Mch. Tool Div., Blossom Road, Rochester 10, N. Y.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
G & L and Hypro Div., Giddings & Lewis Mch. Tool Co., Fond du Lac, Wis.
Gorton, George, Machine Co., 1110 W. 13th St., Racine, Wis.
Kearney & Trecker Corp., 6784 W. National, Milwaukee 14, Wis.
Nichols, W. H. Co., Waltham 54, Mass.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

MILLING MACHINES, Knee Type, Horizontal, Plain, Universal

Brown & Sharpe Mfg. Co., Providence, R. I.
Bullard Co., Bridgeport 6, Conn.
Cincinnati Milling & Grinding Mches., Inc., 4701 Marburg Ave., Cincinnati 9, Ohio
Clearing Div., of U.S. Industries, Inc., 6499 W. 65th St., Chicago 38, Ill.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Gorton Geo., Mch., Co., 1110 W. 13th St., Racine, Wis.
Greaves Machine Tool Div., 2009 Eastern Ave., Cincinnati, Ohio
Hardinge Bros., Inc., 1420 College Ave., Elmira, N. Y.
Homestrand, Inc., Larchmont, N. Y.
Ingersoll Milling Machine Co., 505 Fulton Ave., Rockford, Ill.
Kearney & Trecker Corp., 6784 W. National, Milwaukee 14, Wis.
Nichols, W. H. Co., Waltham 54, Mass.
Sheldon Machine Co., Inc., 4240-4258 N. Knox Ave., Chicago 41, Ill.

MILLING MACHINES, Knee Type Ram

Brown & Sharpe Mfg. Co., 235 Promenade St., Providence 1, R. I.
Gorton Mch. Co., 1321 Racine St., Racine, Wis.
Kearney & Trecker Corp., 6784 W. National, Milwaukee 14, Wis.
Van Norman Machine Co., 3640 Main St., Springfield 7, Mass.

MILLING MACHINES, Knee Type Rise and Fall

Cincinnati Milling & Grinding Mches., Inc., 4701 Marburg Ave., Cincinnati 9, Ohio
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Nichols, W. H. Co., Waltham 54, Mass.
Orban, Kurt Co., 42 Exchange Place, Jersey City, N. J.

MILLING MACHINES, Knee Type Turret

Gorton Mch. Co., 1321 Racine St., Racine, Wis.

MILLING MACHINES, Knee Type, Vertical

Bridgeport Mches., Inc., 500 Lindley St., Bridgeport 6, Conn.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling & Grinding Mches., Inc. 4701 Marburg Ave., Cincinnati 9, Ohio
Clearing Div., of U. S. Industries, Inc., 6499 W. 65th St., Chicago 38, Ill.
Cosa Corp., 450 Lexington Ave., New York 17, N. Y.
Gorton, George, Mch. Co., 11110 W. 13th St., Racine, Wis.
Homestrand, Inc., Larchmont, N. Y.
Kearney & Trecker Corp., 6784 W. National, Milwaukee 14, N. Y.
Nichols, W. H. Co., Waltham 54, Mass.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.

MILLING MACHINES, Planer Type

Berthiez, Charles, 5 Rue Montalivet, Paris, France
Consolidated Mch, Tool Div., Blossom Road, Rochester 10, N. Y.
Espen-Lucas Mch. Works, Front St. and Girard Ave., Philadelphia, Pa.
G & L and Hypro Div., Giddings & Lewis Mch Tool Co., Fond du Lac, Wis.
Gray, G. A., Co., Woodburn Ave. and Penn R.R., Evanston, Cincinnati, Ohio
Hamilton Div., Baldwin-Lima-Hamilton Corp., Hamilton, Ohio
Ingersoll Milling Machine Co., 505 Fulton Ave., Rockford, Ill.
Kearney & Trecker, Corp., 6784 W. National, Milwaukee 14, Wis.
Orban, Kurt Co., Inc., 42 Exrhange Place, Jersey City, N. J.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

MILLING MACHINES, Spar

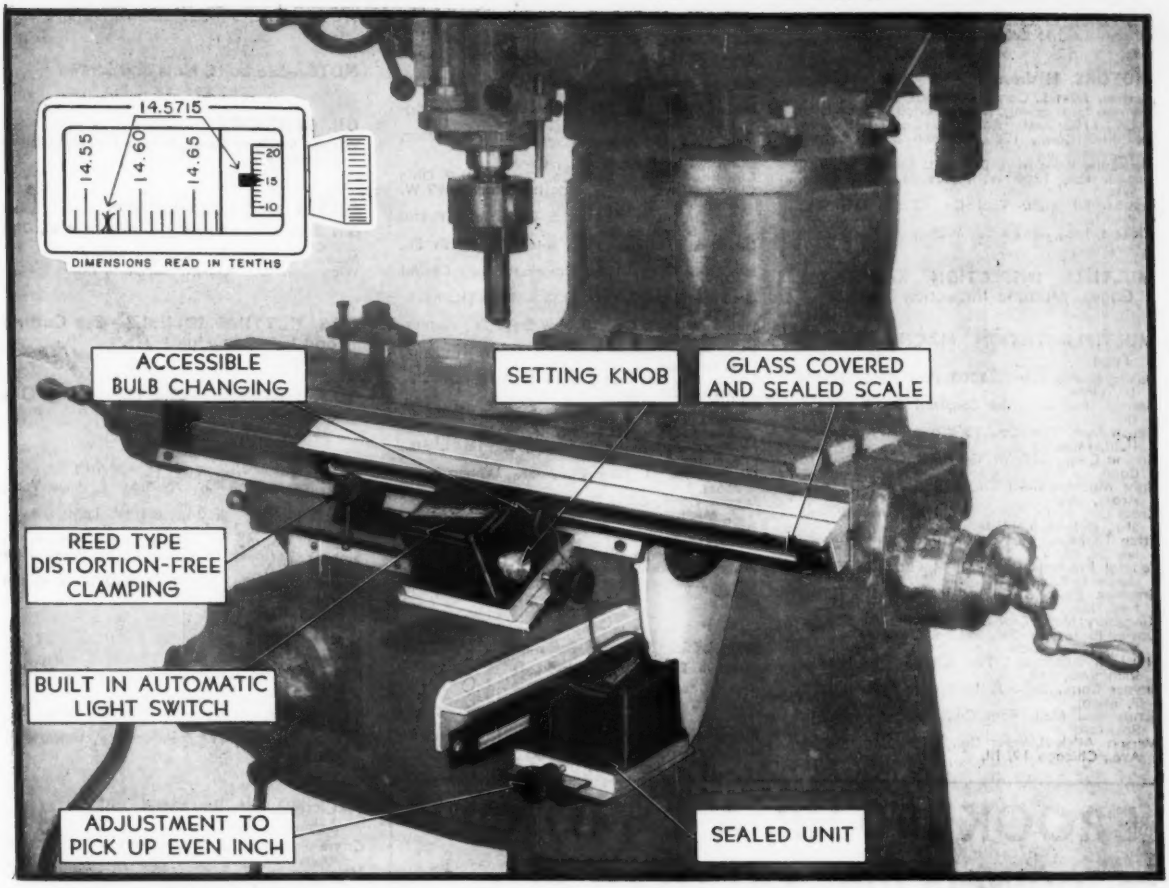
Cincinnati Milling & Grinding Mches., Inc., 4701 Marburg Ave., Cincinnati 9, Ohio
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
G & L and Hypro Div., Giddings & Lewis Mch Tool Co., Fond du Lac, Wis.
Hamilton Div., Baldwin-Lima-Hamilton Corp., Hamilton, Ohio
Kearney & Trecker Corp., 6784 W. National, Milwaukee 14, Wis.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

MOLDING MACHINES, Plastic

Baker Brothers Inc., 1000 Post Ave., Toledo 10, Ohio
Elmes Eng. Div., American Steel Foundries 1150 Tennessee Ave., Cincinati 29, Ohio
Fellows Gear Shaper Co., 78 River St., Springfield, Vt.
Hydraulic Press Mfg. Co., Mount Gilead, Ohio

MOTORS, Air

Ingersoll-Rand Co., Phillipsburg, N. J.



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Further facts are available through your nearest dealer or through us direct.

Bridgeport MACHINES, INC.
Bridgeport, Connecticut
Manufacturers of High Speed Milling Attachments and Turret Milling Machines

For more data, circle this page number on inquiry card

MOTORS, Electric
Lincoln Electric Co., Cleveland 17, Ohio

MOTORS, Hydraulic
Barnes, John S. Corp., Rockford, Ill.
Denison Engineering, Div. American Brake Shoe Co., 1152 Dublin Rd., Columbus 16, Ohio
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Hydraulic Press Mfg. Div., Mt. Gilead, Ohio
Oilgear Co., 1569 W. Pierce St., Milwaukee, Wis.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
Vickers, Inc., Detroit 32, Mich.

MULTIPLE INSPECTION GAGES—See Gages, Multiple Inspection

MULTIPLE-STATION MACHINES, Dial Type
Baker Brothers Inc., 1000 Post Ave., Toledo 10, Ohio
Barnes Drill Co., 814 Chestnut St., Rockford, Ill.
Baush Mch. Tool Co., 15 Wason Ave., Springfield, Mass.
Bodine Corp., 317 Mt. Grove St., Bridgeport 5, Conn.
Buhr Machine Tool Co., 839 Greene St., Ann Arbor, Mich.
Cross Co., P. O. Box 3835, Park Grove Postal Sta., Detroit 5, Mich.
Ettco Tool Co., Inc., 594 Johnson Ave., Brooklyn 37, N. Y.
Federal Products Corp., 1144 Eddy St., Providence 1, R. I.
Greenlee Bros. & Co., 2136 12th St., Rockford, Ill.
Kingsbury Mch. Tool Corp., Keene, N. H.
Lamb, F. Joseph Co., 5663 E. Nine Mile Rd., Detroit 34, Mich.
National Automatic Tool Co., S. 7th N. St., Richmond, Ind.
Snyder Corp., 3400 E. Lafayette Ave., Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2531 - 11th St., Rockford, Ill.
Verson Allsteel Press Co., 9309 S. Kenwood Ave., Chicago 19, Ill.

MULTIPLE-STATION MACHINES, Transfer Type
Baker Brothers Inc., 1000 Post Ave., Toledo 10, Ohio
Barnes Drill Co., 814 Chestnut St., Rockford, Ill.
Baush Mch. Tool Co., 15 Wason Ave., Springfield, Mass.
Buhr Mch. Tool Co., 839 Green St., Ann Arbor, Mich.
Bullard Co., Bridgeport 6, Conn.
Cincinnati Milling Mch. Co., Cincinnati 9, Ohio
Clearing Div., of U. S. Industries, Inc., 6499 W. 65th St., Chicago 38, Ill.
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Norton Co., 1 New Bond St., Worcester 6, Mass.
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Waterbury Farrel Foundry & Mach. Co., Waterbury, Conn.

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NUTS—See Bolts, Nuts and Screws

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Houghton, E. F. & Co., 303 W. Lehigh Ave., Philadelphia 33, Penna.
Shell Oil Co., 50 W. 50th St., New York, N. Y.
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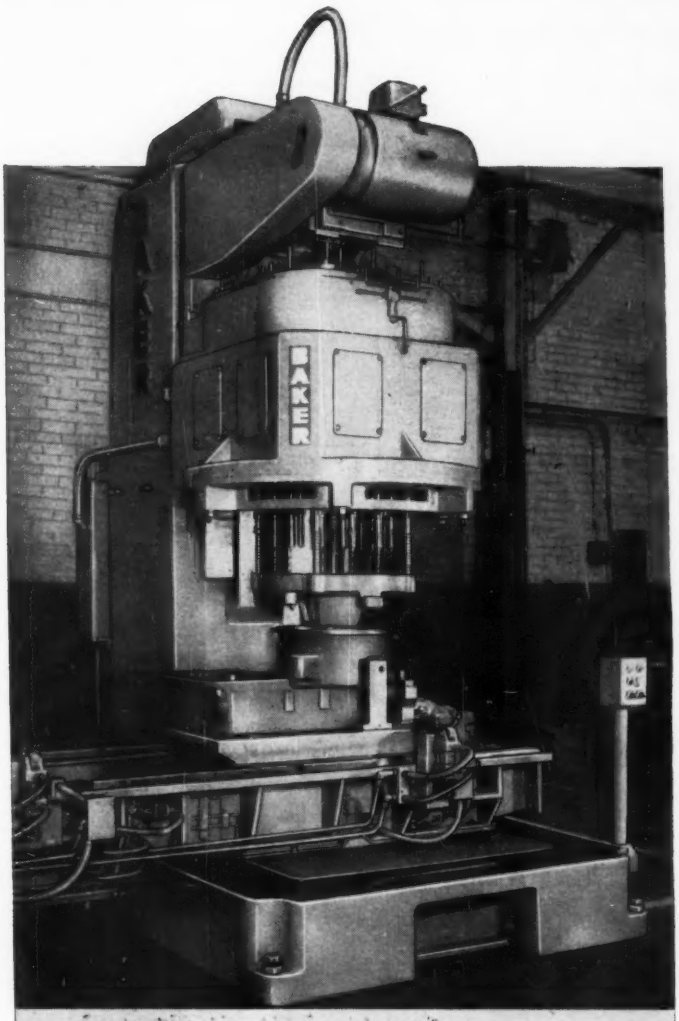

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An automotive contractor's production did not allow for a special machine to work on heavy, hard-to-handle truck transmission housings. Conscious also of retooling costs, the contractor took his problem to the BAKER engineers.

THE RESULT: This A-24-VU Standard Adjustable Spindle Machine, with a few special adaptations. Only accessories added: slip plate, bushing plate and transfer, including pallet.

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SUMP TYPE
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OVER 800
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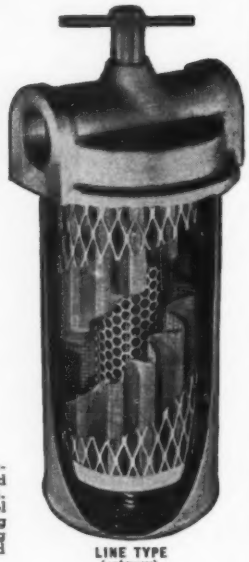

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REDUCE MAINTENANCE

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Federal Press Co., 511 Division St., Elkhart, Ind.
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(Continued on page 290)

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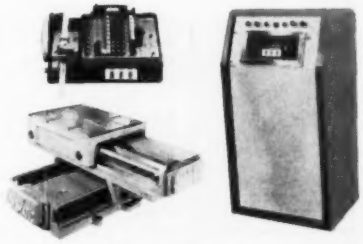

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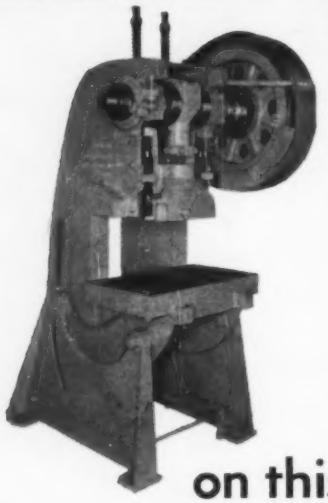

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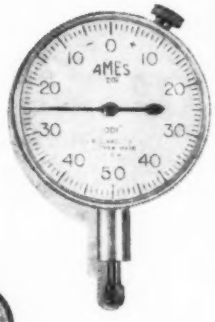

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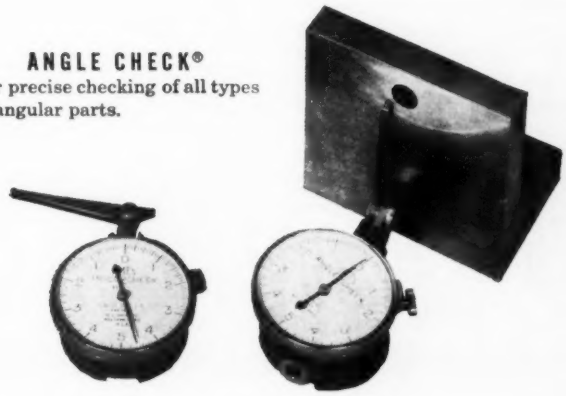

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Wales-Strippit, Inc., Akron, N. Y.

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Cleveland Punch & Shear Wks. Co., 3917 St. Clair Ave., Cleveland 14, Ohio
Danly Machine Specialties, Inc., 2100 South Laramie, Chicago 50, Ill.
Elmes Eng. Div., American Steel Foundries, 1150 Tennessee Ave., Cincinnati 29, Ohio
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Verson Allsteel Press Co., 9309 S. Kenwood Ave., Chicago 19, Ill.
Wales-Strippit, Inc., Akron, N. Y.
Waterbury Farrel Foundry & Mach. Co., Waterbury, Conn.

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Hydraulic Press Mfg. Co., Mount Gilead, Ohio

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Cincinnati Milling & Grinding Machines, Inc., 4701 Marburg Ave., Cincinnati 9, Ohio
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Beatty Machine & Mfg. Co., Hammond, Ind.
Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa.
Bliss, E. W. Co., 1375 Raff Rd., S.W., Canton, Ohio
B-T Machinery Co., Holland, Mich.
Chambersburg Engineering Co., Chambersburg, Pa.
Clearing Div., of U. S. Industries, Inc., 6499 W. 65th St., Chicago 38, Ill.
Cleveland Punch & Shear Wks., Co., 3917 St. Clair Ave., Cleveland 14, Ohio
Danly Machine Specialties, Inc., 2100 South Laramie, Chicago 50, Ill.
Denison Engineering, Div. American Brake Shoe Co., 1152 Dublin Rd., Columbus 16, Ohio
Elmes Eng. Div., American Steel Foundries, 1150 Tennessee Ave., Cincinnati 29, Ohio
Erie Foundry Co., 1253 W. 12th St, Erie, Penna.
Federal Press Co., 511 Division St., Elkhart, Ind.
Hydraulic Press Mfg. Co., Mount Gilead, Ohio
L & J Press Corp., 1631 Sterling Ave., Elkhart, Ind.
Minster Machine Co., Minster, Ohio
Niagara Machine & Tool Wks., 637 Northland Ave., Buffalo 11, N. Y.
Verson Allsteel Press Co., 9309 S. Kenwood Ave., Chicago 19, Ill.

PROFILING MACHINES—See Milling Machines, Die Sinking, etc.

PULLEYS
Brown & Sharpe Mfg. Co., Providence, R. I.
DoALL Co., Des Plaines, Ill.

PUMPS, Coolant and Lubricant
Barnes, John S., Corp., Rockford, Ill.
Brown & Sharpe Mfg. Co., Providence, R. I.
DoALL Co., Des Plaines, Ill.
Ingersoll-Rand Co., Phillipsburg, N. J.
Little Giant Pump Co., 5101 Classen Blvd., Oklahoma City 18, Okla.
Logansport Machine Co., Inc., 810 Center Ave., Logansport, Ind.
Ruthman Machinery Co., 1809 Reading Rd., Cincinnati, 2, Ohio

PUMPS, Hydraulic
Barnes, John S., Corp., Rockford, Ill.
Brown & Sharpe Mfg. Co., Providence, R. I.
Denison Engineering, Div. American Brake Shoe Co., 1152 Dublin Rd., Columbus 16, Ohio
Elmes Eng. Div., American Steel Foundries, 1150 Tennessee Ave., Cincinnati 29, Ohio
Hydraulic Press Mfg. Co., Mount Gilead, Ohio
Oilgear Co., 1569 W. Pierce St., Milwaukee, Wis.
Sundstrand Machine Tool Co., 2531 11th St., Rockford, Ill.
Vickers Incorporated, Division of Sperry Rand Corp., 1402 Oakman Blvd., Detroit, Mich.

PUNCHES AND DIES—See Dies, Blanking, etc.

REAMERS, Rose, Chucking, Jobbers Taper, Shell, Adjustable, etc.
Barber-Colman Co., 1300 Rock St., Rockford, Ill.
Chicago-Latrobe, 411 W. Ontario St., Chicago 10, Ill.
Cleveland Twist Drill Co., 1242 49th St., Cleveland, Ohio
Cogsdill Twist Drill Co., Greenfield, Mass.
DoALL Co., Des Plaines, Ill.

(Continued on page 294)

• *Higher Cutting Speeds*
• *Lower Production Costs*

NEW Jarvis PRODUCTS!

NEW SOLID CARBIDE CUTTING TOOLS

J015 Boring Tool

J704 Countersink

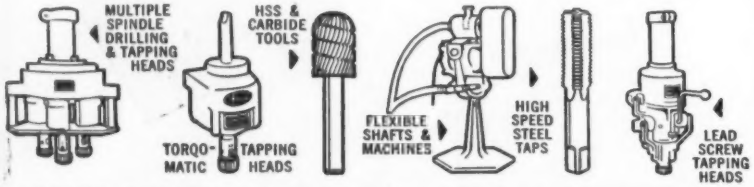
J564-R Reamer

The New "Drillspeeder"

The Jarvis Drillspeeder converts your ordinary drill press into a high speed drilling machine! This new precision attachment features a 4 to 1 gear ratio, is adaptable to any conventional style of drill press spindle. Maximum speed: 30,000 RPM.

Lower your production costs with Jarvis solid carbide cutting tools! These rugged carbide tools let you use optimum speeds and feeds . . . stay sharp and accurate longer between grinds.

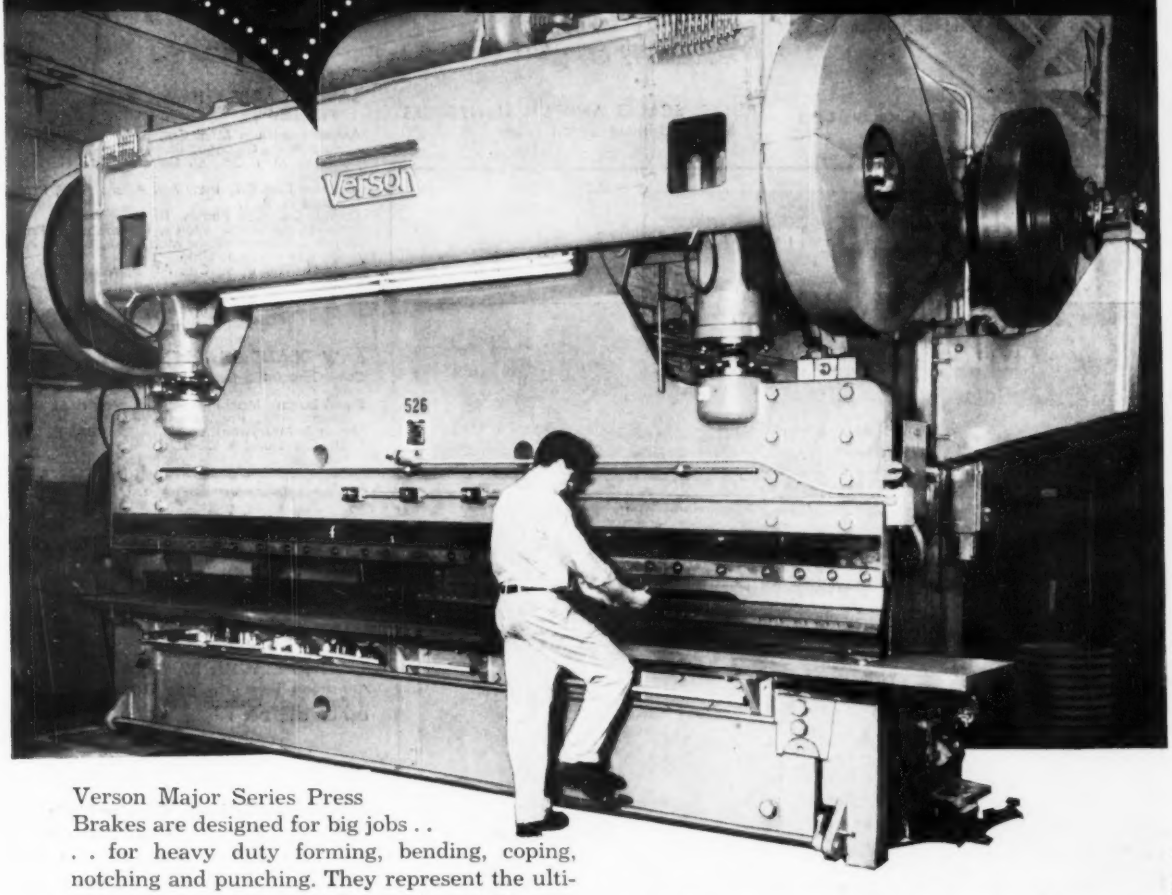
In addition to making a broad line of standard solid carbide cutting tools, Jarvis will design and deliver "specials" to meet your requirements.


MULTIPLE SPINDLE DRILLING & TAPPING HEADS
HSS & CARBIDE TOOLS
TORQO-MATIC TAPPING HEADS
FLEXIBLE SHAFTS & MACHINES
HIGH SPEED STEEL TAPS
LEAD SCREW TAPPING HEADS

JARVIS CORPORATION • MIDDLETOWN, CONNECTICUT

for BIG JOBS...for Precision Performance...

Choose Verson Major Series Press Brakes



Verson Major Series Press Brakes are designed for big jobs . . . . . for heavy duty forming, bending, coping, notching and punching. They represent the ultimate in press design for strength, rigidity, endurance, accuracy and power.

Compare the design features of Verson Major Series Press Brakes against any other make . . . you'll see why these machines have earned such wide acceptance among manufacturers who demand the utmost in performance, precision and production.

Verson also offers four other basic lines of mechanical press brakes . . . smaller in size. A complete line of hydraulically operated press brakes is also available.

Whatever your requirements, there is a Verson Brake to fit your particular job. Let Verson application engineers help you in making your selection. Call or write, today.

Send for CATALOG B-55

From 15 tons up, there is a Verson Power Press Brake to meet every requirement for forming, bending, coping, notching or punching. Send for your copy of this 28-page informative catalog. There is no obligation, of course.

A Verson Press for every job from 60 tons up.

215

Verson

ORIGINATORS AND PIONEERS OF ALLSTEEL STAMPING PRESS CONSTRUCTION

VERSON ALLSTEEL PRESS CO.

9309 S. KENWOOD AVENUE, CHICAGO 19, ILLINOIS • 8300 S. CENTRAL EXPRESSWAY, DALLAS, TEXAS

MECHANICAL AND HYDRAULIC PRESSES AND PRESS BRAKES • TRANSMAT PRESSES • TOOLING • DIE CUSHIONS • VERSON-WHEELON HYDRAULIC PRESSES

For more data, circle this page number on inquiry card

Greenfield Tap & Die Corp., Greenfield, Mass.
Jarvis Corp., Stack Ave., Middletown, Conn.
Tomkins-Johnson Co., 617 N. Mechanic St., Jackson, Mich.

REELS, Stock
National Acme Co., 170 E. 131st St., Cleveland 3, Ohio
U. S. Tool Co., Inc., 255 North 18th St., Ampere, E. Orange, N. J.

REFRACTORS Heat-Treating Furnaces
Norton Co., 1 New Bond St., Worcester 6, Mass.

RETAINING RINGS
Waldes Kohinoor, Inc., 47-16 Austel Pl., Long Island City 1, N. Y.

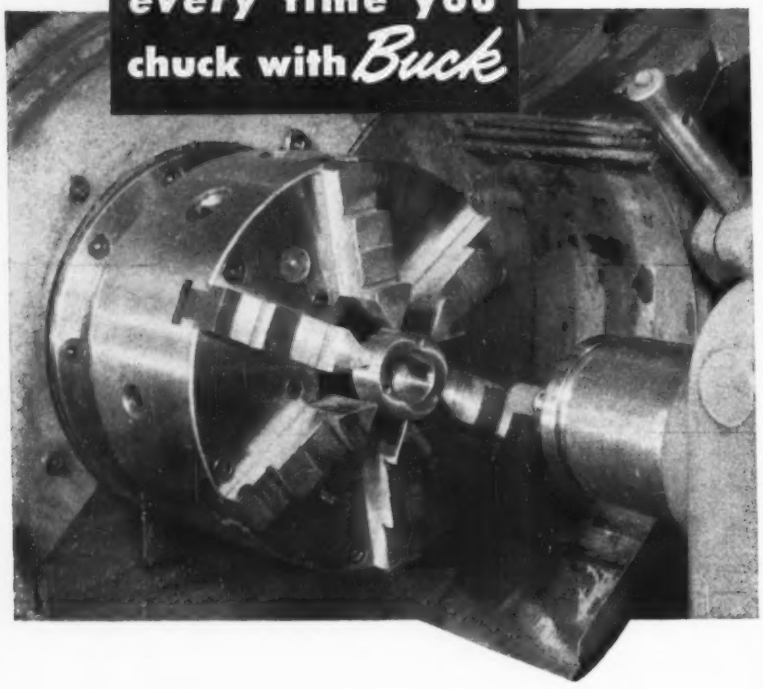
RIVETERS, Portable
Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.

RIVETERS, Stationary
Brown & Sharpe Mfg. Co., 35 Promenade St., Providence 1, R. I.
Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.
Tompkins-Johnson Co., 617 N. Mechanic St., Jackson, Mich.

ROTARY TABLES, Optical
Machine Products Corp., 6771 E. McNichols Rd., Detroit 12, Michigan

RULES, SCALES AND STRAIGHTEDGES
See Machinists' Small Tools

YOU make money every time you chuck with *Buck*



1. You get *dead true* precision chucking single parts—.0005" precision on duplicate parts. (Conventional chucks are only accurate to .003" *when new.*)

2. You save costly machinists' time. Takes but a minute to indicate and adjust a Buck. No fooling around with shims.

3. The Buck Ajust-Tru® principle helps compensate for spindle run-out, compensates for chuck wear—greatly lengthens chuck life.

Buck Ajust-Tru 3- and 6-jaw chucks cost no more than conventional chucks. Send for catalog—see for yourself why "It pays to chuck with Buck."

Makers of Scroll, Power, Dust Proof, Independent Chucks.

BUCK TOOL COMPANY
620 SCHIPPERS LANE • KALAMAZOO, MICH.

RUST INHIBITORS
Houghton, E. F. & Co., 303 W. Lehigh Ave., Philadelphia 33, Penna.
Oakite Products, Inc., 26 Rector St., New York, N. Y.
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.
Shell Oil Co., 50 W. 50th St., New York, N. Y.

SAND BLAST EQUIPMENT—See Blast Cleaning Equipment

SAW BLADES, Hack, Band, Circular Friction
Armstrong-Blum Mfg. Co., 5700 W. Bloomingdale Ave., Chicago, Ill.
Capewell Mfg. Co., 60 Governor St., Hartford, Conn.
Circular Tool Co., Inc., 765 Allens Ave., Providence 5, R. I.
DoALL Co., Des Paines, Ill.
Espen-Lucas Mach Works, Philadelphia, Pa.
Motch & Merryweather Mchy. Co., 888 E. 70th St., Cleveland 3, Ohio
Starrett, The L. S., Co., Athol, Mass.

SAW BLADE SHARPENERS
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Espen-Lucas Machine Works, Front St. and Girard Ave., Philadelphia, Pa.
Motch & Merryweather Mchy. Co., 888 E. 70th St., Cleveland 3, Ohio

SAWING MACHINES, Abrasive Machines—See Cutting-off Saws, Abrasive Wheel

SAWING MACHINES, Band
Armstrong-Blum Mfg. Co., 5700 W. Bloomingdale Ave., Chicago, Ill.
DoALL Co., Des Plaines, Ill.

SAWING MACHINES, Circular Blade
Consolidated Mch. Tool Div., Blossom Road, Rochester 10, N. Y.
Espen-Lucas Machine Works, Front St. and Girard Ave., Philadelphia, Pa.
Motch & Merryweather Mchy. Co., 888 E. 70th St., Cleveland 3, Ohio
Ty-Sa-Man Machine Co., Inc., 1093 White Ave., Knoxville, Tenn.

SAWING MACHINES, Power Hack
Armstrong-Blum Mfg. Co., 5700 W. Bloomingdale Ave., Chicago, Ill.
Chicago Pneumatic Tool Co., 6 E. 44th St., New York 17, N. Y.

SAWS, Screw-slotting—See Cutters, Milling

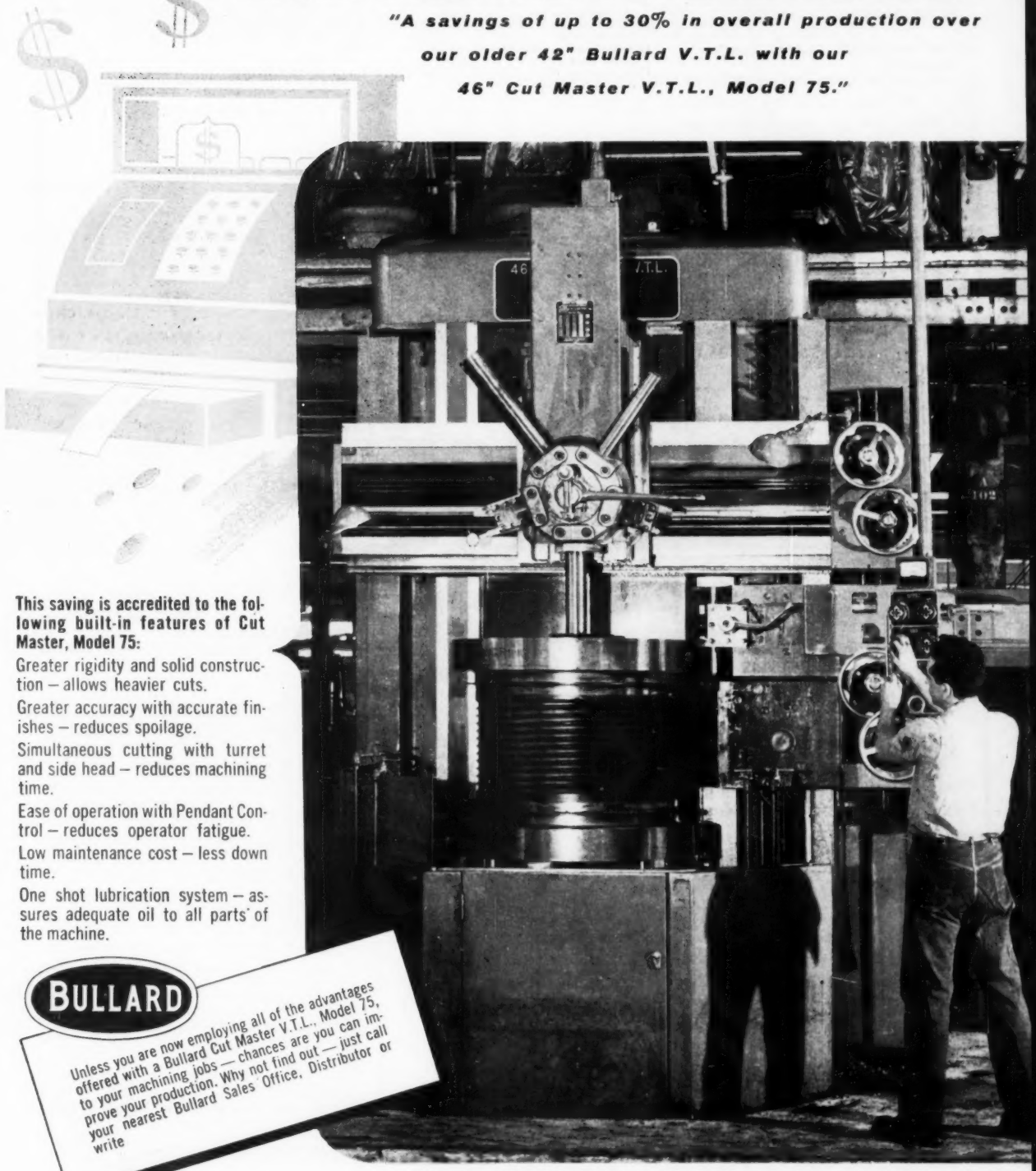
SCREW DRIVERS, STUD AND NUT SETTERS, Power
Bodine Corp., 317 Mt. Grove St., Bridgeport 5, Conn.
Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.
Consolidated Mch. Tool Div., Blossom Road, Rochester 10, N. Y.

(Continued on page 296)

It Pays To Replace

An analysis of cost records at Philadelphia Gear Corporation, Philadelphia, Pa., shows, according to Mr. John Walker, Shop Foreman,

"A savings of up to 30% in overall production over our older 42" Bullard V.T.L. with our 46" Cut Master V.T.L., Model 75."



This saving is accredited to the following built-in features of Cut Master, Model 75:

Greater rigidity and solid construction – allows heavier cuts.

Greater accuracy with accurate finishes – reduces spoilage.

Simultaneous cutting with turret and side head – reduces machining time.

Ease of operation with Pendant Control – reduces operator fatigue.

Low maintenance cost – less down time.

One shot lubrication system – assures adequate oil to all parts of the machine.

BULLARD

Unless you are now employing all of the advantages offered with a Bullard Cut Master V.T.L., Model 75, to your machining jobs — chances are you can improve your production. Why not find out — just call your nearest Bullard Sales Office, Distributor or write

4,000 pound Drum for gate hoist which is bored, faced and turned on 46" Bullard Cut Master V.T.L., Model 75.

THE BULLARD COMPANY BRIDGEPORT 9, CONN.

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Cross Co., P. O. Box 3835, Park Grove Postal Sta., Detroit 5, Mich.
Scully-Jones & Co., 1906 Rockwell St., Chicago 8, Ill.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

SCREW MACHINES, Hand—See Lathes, Turret, Ram-type, Saddle-type

SCREW MACHINES, Multiple-Spindle Automatic

Greenlee Bros. & Co., 2136 12th St., Rockford, Ill.
National Acme Co., 170 E. 31st St., Cleveland, Ohio
New Britain Mch. Co., New Britain-Gridley Mch. Div., New Britain, Conn.
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 3, Ohio

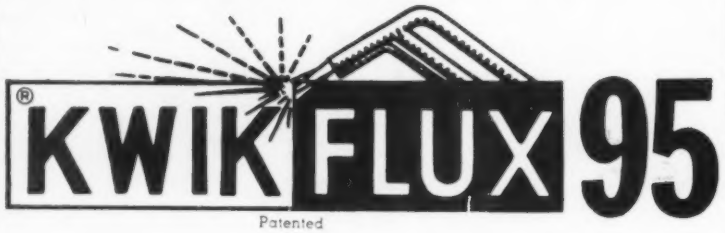
SCREW MACHINES, Single-Spindle Automatic

Brown & Sharpe Mfg. Co., Providence, R. I.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Gear Grinding Machine Co., 3901 Christopher St., Detroit 11, Mich.
Gisholt Mch. Co., 1245 E. Washington Ave., Madison 10, Wis.
Gorton, George Mch. Co., 1110 W. 13th St., Racine, Wis.
National Acme Co., 170 E. 131st St., Cleveland, Ohio
New Britain Mch. Co., New Britain-Gridley Mch. Div., New Britain, Conn.

SCREW PLATES

Greenfield Tap & Die Corp., Greenfield, Mass.
Threadwell Tap & Die Co., 16 Arch St., Greenfield, Mass.

PREVENT FIRE SCALE and OXIDATION in HARDENING PROCESSES with



Patented

SAVES CLEANING • PRESERVES FINISH

Leading machine tool manufacturer says:
"KWIKFLUX 95 is used to prevent fire scale and oxidation during hardening and thereby preserves the finish." . . .

See "Gearing for High Gear Production" in this issue.

Tops in protection and proven successful, KWIKFLUX 95 withstands 1,800° F. for maximum surface protection. Water soluble—excess flux washes away easily and completely. Saves time and cleaning costs.

Specialists in Protective Coverings

Special Chemicals, pioneers and leaders in the development of high temperature protective coatings, maintain a continuous program of research and product improvement. There's a specialized KWIKFLUX for every metal protection job from 400° F. to 2,300° F. Over 27 years of know-how are back of these fine compounds.

Our engineers will custom design and prove a process tailored to your needs. Write us your requirements.

SPEC SPECIAL CHEMICALS CORP.
100 SOUTH WATER ST., OSSINING, N. Y.

SCREWS, Cap, Set, Self-tapping, etc.—See Bolts, Nuts and Screws

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Gits Bros. Mfg. Co., 1858 S. Kilbourn Ave., Chicago, Illinois

SEPARATORS, Magnetic

Barnes Drill Co., 814 Chestnut St., Rockford, Ill.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

SET-UP EQUIPMENT

Armstrong Bros. Tool Co., 5213 W. Armstrong Ave., Chicago 46, Ill.
Lufkin Rule Co., Saginaw, Mich.
Starrett, The L. S., Co., Athol, Mass.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

SHAPERS, Crank and Hydraulic

Cincinnati Shaper Co., P. O. Box 111, Cincinnati 11, Ohio
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Nebel Machine Tool Corp., 3401 Central Pkwy, Cincinnati 25, Ohio
Orban Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Rockford Mch. Tool Co., 2500 Kishwaukee St., Rockford, Ill.
Sheldon Mch. Co., Inc., 4240-4258 N. Knox Ave., Chicago 41, Ill.

SHAPERS, Vertical and Slotters

Bridgeport Mches., Inc., 500 Lindley St., Bridgeport 6, Conn.
Consolidated Mch. Tool Div., Blossom Road, Rochester 10, N. Y.
Orban, Kurt Co., 42 Exchange Place, Jersey City 2, N. J.
Rockford Mch. Tool Co., 2500 Kishwaukee St., Rockford, Ill.

SHEARS, Alligator

Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio

SHEARS, Guillotine Bar

Beatty Machine & Mfg. Co., Hammond, Ind.

SHEARS, Rotary

Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Niagara Mch. & Tool Works, 683 Northland Ave., Buffalo, N. Y.

SHEARS, Squaring

Birdsboro Steel Fdy. & Mch. Co., Birdsboro, Pa.
Cincinnati Shaper Co., P. O. Box 111, Cincinnati 11, Ohio
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25, Ohio
Niagara Mch. & Tool Works, 683 Northland Ave., Buffalo, N. Y.

SHEET METALS—See Strip and Sheet, Ferrous, Non-ferrous

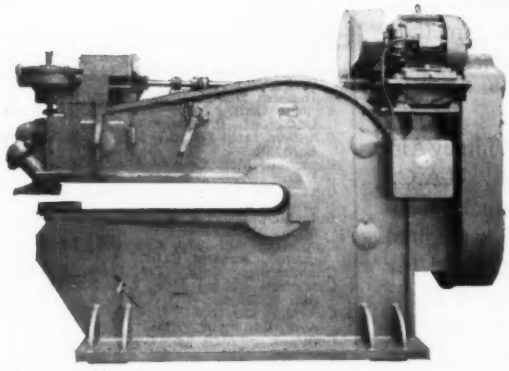
SHIM STOCK

Laminated Shim Co., Inc., Glenbrook, Conn.

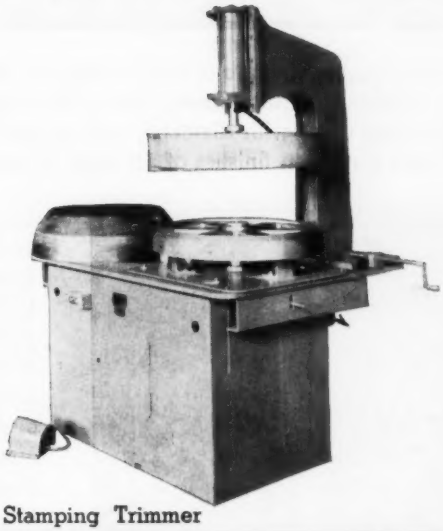
SLITTING MACHINES, Rotary

Bliss Co., E. W., Canton, Ohio
Niagara Mch. & Tool Works, 683 Northland Ave., Buffalo 11, N. Y.
Waterbury Farrel Foundry & Mach. Co., Waterbury, Conn.
Yoder Co., 5504 Walworth Ave., Cleveland 2, Ohio

New Additions To The BEATTY Line of Metalworking Equipment

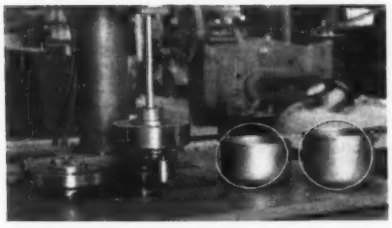


Rotary Shear

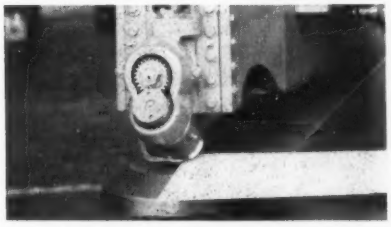


Stamping Trimmer

BEATTY-QUICKWORK



Beatty-Quickwork trimmer trims flash from almost any kind of stamping in a single plane.



Beatty-Quickwork rotary shear cuts, bevels, circles, flanges and joggles plate and sheet metal up to 1" mild steel.

ROTARY SHEARS and STAMPING TRIMMERS

QUICKWORK — leading name in precision machine tools — Rotary Shears and Stamping Trimmers — is now a part of the famous BEATTY family of metalworking equipment. This new acquisition (from the Whiting Corporation, Harvey, Ill.) is an important step in bringing you a more complete line of cost-saving, high-production metalworking equipment from one reliable source — BEATTY. The BEATTY-QUICKWORK Rotary Shears and Stamping Trimmers are distributed through Quickwork and Beatty dealers. We invite your inquiry concerning Beatty-Quickwork and other Beatty equipment — presses, punches, shears and bulldozers — which can help you cut costs; solve your metalworking problems economically, faster and with the precision for which Beatty and Quickwork are well known.

BEATTY-QUICKWORK

Division of BEATTY MACHINE & MFG. CO.

941 150th St., Hammond, Indiana

For more data, circle this page number on inquiry card

WHY Pratt & Whitney MICROHONES Bores In Titanium Spacers

Rotor disc spacers, that are used in jet engines, require accurate bores having consistent surface finish. Thus, the final processing method must generate bores with diametric and geometric accuracies within .0005" and consistent finishes of 15 microinches.

But, Pratt & Whitney Aircraft Division, U.A.C., faced additional problems in selecting the final processing method for these .110" length bores in titanium spacers. Because the spacers are manufactured in 20 different heights and bores in two diameters, efficient production demanded extreme versatility of the processing method used.

Here's why Pratt & Whitney chose the Microhoning process and equipment to economically produce the required results: Microhoning, in removing .004" of stock from each bore, accurately holds to size and finish requirements; and because the fixturing positions all 20 spacer heights at same work level, the tool stroke never needs adjustment. The Microhoning of all 16 bores in each titanium spacer is completed in about 7 minutes (including loading and unloading time).

Learn why Microhoning will give efficient stock removal, closer tolerances, accurate alignment and functional surfaces.

☐ Please have a Micromatic Field Engineer call.
☐ Please send Micromatic literature and case histories.

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SLOTTERS—See Shapers, Vertical and Slotters

SOCKETS—See Drill Sleeves and Extension Holders

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Barnes, John S. Corp., Rockford, Ill.
National Acme Co., 170 E. 131st St., Cleveland 3, Ohio
Vickers, Inc., Detroit 32, Mich.

SPECIAL MACHINERY AND TOOLS

Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Barnes, W. F. & John Co., 201 S. Water St., Rockford, Ill.
Baush Machine Tool Co., 156 Wason Ave., Springfield 7, Mass.
Bethlehem Steel Co., Bethlehem, Pa.
Bilgram Gear & Mch. Works, 1217-35 Spring Garden St., Philadelphia, Pa.
Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa.
Blanchard Mch. Co., 64 State St., Cambridge, Mass.
Bliss, E. W. Co., 1375 Raff Rd., S. W., Canton, Ohio
Buhr Mch. Tool Co., 839 Green St., Ann Arbor, Mich.
Burg Tool and Mfg. Co., Inc., 15001 S. Figueroa, Gardena, Calif.
Chambersburg Engrg. Co., Chambersburg, Pa.
Cincinnati Milling Mch. Co., Oakley, Cincinnati 9, Ohio.
Columbus Die-Tool & Mch. Co., 955 Cleveland Ave., Columbus, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Cross Co., 3250 Bellevue, Detroit 7, Mich.
Erie Foundry Co., Erie, Pa.
Espen-Lucas Mch. Works, Front St. and Girard Ave., Philadelphia, Pa.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Federal Machine & Welder Co., Overland Ave., Warren, Ohio.
Fellows Gear Shaper Co., 78 River St., Springfield, Vt.
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.
Gorton, Geo., Mch. Co., 1110 W. 13th St., Racine, Wis.
Greenlee Bros. & Co., 12th and Columbia Aves., Rockford, Ill.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.
Hydraulic Press Mfg. Co., Mt. Gilead, Ohio.
Ingersoll Milling Machine Co., 505 Fulton Ave., Rockford, Ill.
Kingsbury Mch. Tool Corp., Keen, N. H.
Lamb, F. Joseph Co., 5663 E. Nine Mile Rd., Detroit 34, Mich.
Le Maire Machine Tool Co., 2657 S. Telegraph Rd., Dearborn, Mich.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
Modern Industrial Engrg. Co., 14230 Birwood, Detroit 4, Mich.
Moline Tool Co., 102 20th St., Moline, Ill.
Motch & Merryweather Mchy. Co., 888 E. 70th St., Cleveland 3, Ohio.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.
National Automatic Tool Co., Inc., S. 7th and N Sts., Richmond, Ind.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.
National Twist Drill & Tool Co., Rochester, Mich.
New Britain Mch. Co., New Britain-Gridley Mch. Div., New Britain, Conn.
New Jersey Gear & Mfg. Co., 1470 Chestnut Ave., Hillside, N. J.
Niagara Mch. & Tool Works, 683 Northland Ave., Buffalo, N. Y.
Oilgear Co., 1569 W. Pierce St., Milwaukee, Wis.
Sheffield Corp., Box 893, Dayton 1, Ohio
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio.
Sundstrand Mch. & Tool Co., 2531 11th St., Rockford, Ill.
Universal Engrg. Co., Frankenmuth 2, Mich.
Verson Allsteel Press Co., 93rd St., & S. Kenwood Ave., Chicago, Ill.
Wicaco Machine Corp., Wayne Junction, Philadelphia, Pa.

SPEED REDUCERS

Barnes, John S. Corp., Rockford, Ill.
Boston Gear Works, 320 Main St., North Quincy 71, Mass.
Horsburgh & Scott Co., 5114 Hamilton, Cleveland, Ohio.
James, D. O., Gear Mfg. Co., 1140 W. Monroe St., Chicago 7, Ill.

SPINDLES, Machine
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
National Automatic Tool Co., S. 7th and N Sts., Richmond, Ind.
Standard Electrical Tool Co., 2488-90 River Road, Cincinnati, Ohio.

SPRAYING EQUIPMENT, Metal
Metallizing Eng. Co., Westbury, L. I., N. Y.

SPROCKETS—See Gears, Cut

STAMPINGS, Sheet Metal
Laminated Shim Co., Inc., Glenbrook, Conn.
Revere Copper & Brass Inc., 230 Park Ave., New York, N. Y.

STEEL ALLOYS—See Alloy Steels

STEEL, Cold Rolled, Stainless, High-speed, Tool, etc.
Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Carpenter Steel Co., 105 W. Bern St., Reading, Penna.
Jessop Steel Co., Washington, Penna.
Ryerson, Jos. T., & Son, Inc., 16th & Rockwell Sts., Chicago 8, Ill.
Timken Roller Bearing Co., Canton, Ohio.
Vanadium-Alloys Steel Co., Latrobe, Penna.
Wheelock, Lovejoy & Co., Inc., Cambridge, Mass.

STEEL DISTRIBUTORS
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Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.
Landis Mch. Co., Waynesboro, Pa.
Threadwell Tap & Die Co., Greenfield, Mass.

STRAIGHTEDGES—See Machinists' Small Tools

STRAIGHTENERS, Flat Stock and Wire
Bliss Co., E. W., Canton, Ohio.
Niagara Mch. & Tool Wks., 637-697 Northland Ave., Buffalo 11, N. Y.
U. E. Tool Co., Inc., 255 North 18th St., Ampere, E. Orange, N. J.
Verson Allsteel Press Co., 9309 S. Kenwood Ave., Chicago 19, Ill.
Waterbury Farrel Foundry & Mach. Co., Waterbury, Conn.

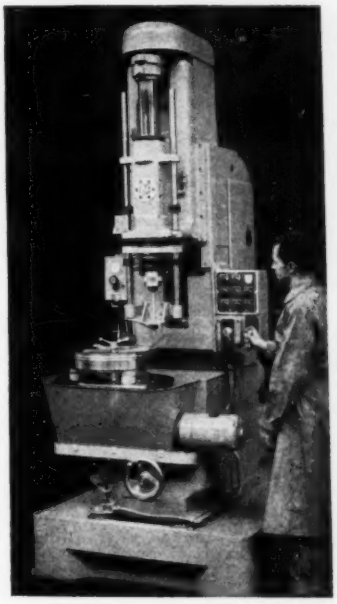
STRIP AND SHEET, Ferrous
Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Carpenter Steel Co., 105 W. Bern St., Reading, Penna.
Ryerson, Jos. T., & Son, Inc., 16th & Rockwell Sts., Chicago 8, Ill.

STRIP AND SHEET, Non-ferrous
American Brass Co., 25 Broadway, New York, N. Y.
Bethlehem Steel Co., Bethlehem, Pa.
Bridgeport Brass Co., Bridgeport, Conn.
Jessop Steel Co., Washington, Penna.
Ryerson, Jos. T., & Son, Inc., 16th & Rockwell Sts., Chicago 8, Ill.

HOW Pratt & Whitney MICROHONES Bores In Titanium Spacers

By Microhoning the bores in rotor disc spacers used in jet engines, Pratt & Whitney obtains final stock removal that efficiently produces close diametric and geometric accuracies (within .0005") and consistent surface finishes of 15 microinches.

Here's how a Hydrohoner produces these accurate results in 20 different sizes of titanium spacers . . . each spacer having 16 bores that are either .680" or .590" in diameter and .110" in length.



The Hydrohoner is equipped with precise feed and sizing controls that automatically expand and collapse the tool, compensate for abrasive wear, and terminate the Microhoning cycle when required bore size is reached. Also, because fixturing is designed to position all spacers at the same work level, the tool stroke never needs adjustment.

A rotary indexing table automatically locates each bore under the spindle and stops the Hydrohoner when all 16 bores in each spacer are finished. A lateral indexing feature positions the fixture to accommodate various spacer sizes. In fixture change-over, no special tools are required for simple exchanging of four details, and the switch from one spacer size to another requires but a few minutes.

☐ Please send me your movie "Progress in Precision" in time for showing on _____(date).
☐ Please have a Micromatic Field Engineer call.
☐ Please send Microhoning literature and case histories.

PRECISION PRODUCTION THROUGH MICROHONING
MICRO MATIC

NAME _____
TITLE _____
COMPANY _____
STREET _____
CITY _____ ZONE _____ STATE _____ L

MICROMATIC HONE CORP.
8100 SCHOOLCRAFT AVENUE · DETROIT 38, MICHIGAN

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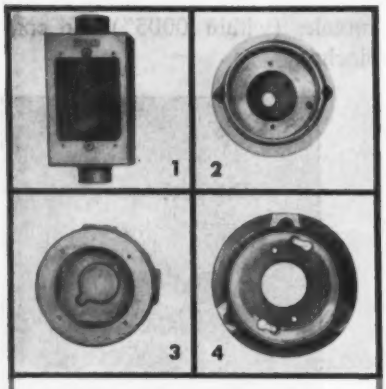
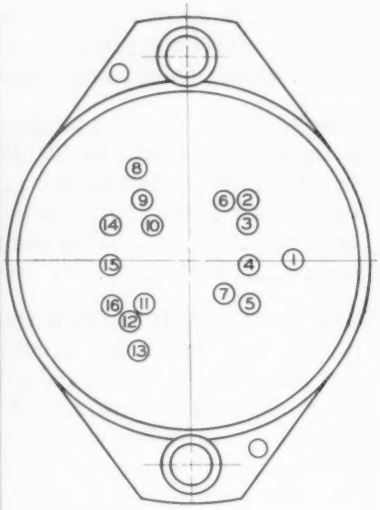
Get Adjustable Head Flexibility with ZAGAR Fixed Center Heads for Drilling, Reaming and Tapping

● ***ADD SPINDLES***
AT REDUCED COST PER SPINDLE

● ***INCREASE PRODUCTION***
AT REDUCED COST PER PIECE





PART 1: Spindles 3, 4, 5, 14, 15, 16
PART 2: Add Spindles 2, 7, 10, 12
PART 3: Add Spindles 9, 11
PART 4: Add Spindles 1, 8, 13

When 16 Spindles to Produce 4 Pieces Are Used—

- Cost Per Spindle REDUCED 50%
- Cost Per Piece REDUCED 66%

This simple illustration proves Zagar's point — that production is in direct proportion to number of spindles used. With the Zagar *gearless* principle, holes on any center can be drilled, reamed or tapped. With fixed center heads, you eliminate many hazards of drilling by other methods. Yet you get a flexibility unmatched by any other equipment.

Write for cost details on print "M-6".

Zagar

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TOOLS FOR INDUSTRY and SPECIAL MACHINERY

STRUCTURAL SHAPES
Bethlehem Steel Co., Bethlehem, Pa.
Revere Copper & Brass, Inc., 230 Park Ave., New York 17, N. Y.
Ryerson, Jos. T., & Son, Inc., 16th & Rockwell Sts., Chicago 8, Ill.

STUD SETTERS—See Screwdrivers, etc.

SUPERFINISHING EQUIPMENT
Gishold Machine Co., 1245 E. Washington Ave., Madison 10, Wis.

SURFACE PLATES
Brown & Sharpe Mfg. Co., 235 Promenade St., Providence 1, R. I.
DoALL Co., Des Plaines, Ill.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.

SWITCHES, Limit
Allen-Bradley Co., 1331 So. 1st St., Milwaukee, Wis.

TACHOMETERS—See Indicators, Speed

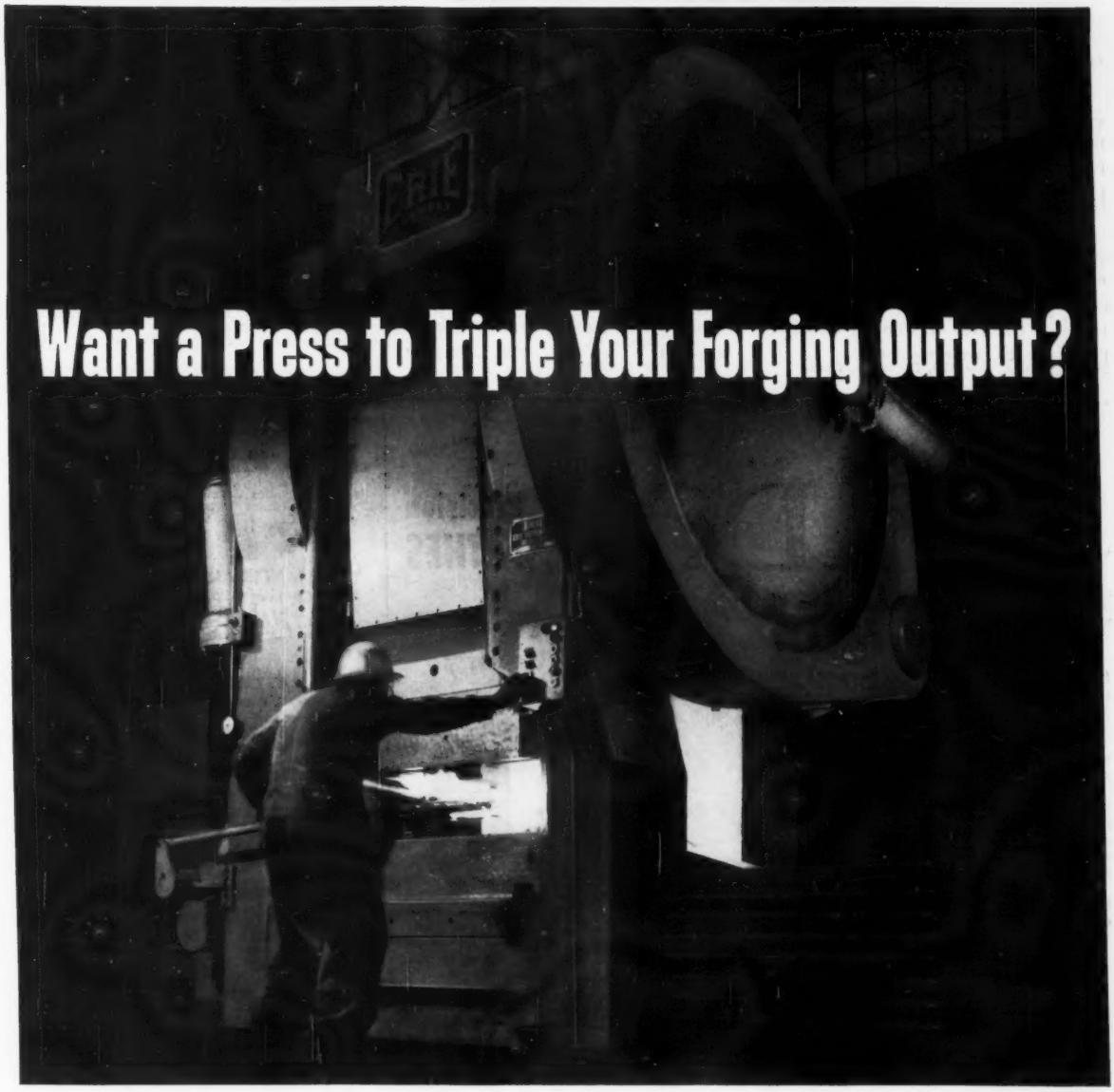
TAP HOLDERS
Brown & Sharpe Mfg. Co., 235 Promenade St. Providence 1, R. I.
Burgmaster Corp., 15001 S. Figeroa, Gardena, Calif.
Ettco Tool Co., Inc., 594 Johnson Ave., Brooklyn 37, N. Y.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
National Automatic Tool Co., S. 7th and N Sts., Richmond, Ind.

TAPPING HEADS
Baker Brothers Inc., 1000 Post Ave., Toledo 10, Ohio.
Davis Boring Tool Div., Giddings & Lewis Mch. Tool Co., Fond du Lac, Wis.
Ettco Tool Co., Inc., 594 Johnson Ave., Brooklyn 37, N. Y.
Jarvis Corp., Stack Ave., Middletown, Conn.
Kato Mfg. Co., Osaka, Japan.
Lamb, F. Joseph Co., 5663 E. Nine Mile Rd., Detroit 34, Mich.
Leland-Gifford Co., 1425 Southbridge St., Worcester, Mass.
National Automatic Tool Co., S. 7th & N Sts., Richmond, Ind.
Thriftmaster Products Corp., 1076 N. Plum St., Lancaster, Pa.
Zagar, Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio.

TAPPING MACHINES
Baker Brothers Inc., 1000 Post Ave., Toledo 10, Ohio.
Baush Machine Tool Co., 15 Wason Ave., Springfield 7, Mass.
Bodine Corp., 317 Mt. Grove St., Bridgeport 5, Conn.
Buhr Machine Tool Co., 839 Greene St., Ann Arbor, Mich.
Burg Tool and Mfg. Co., Inc., 15001 S. Figueroa, Gardena, Calif.
Chicago Pneumatic Tool Co., 6 E. 44th St., New York 17 N. Y.
Cincinnati Bickford Div. of Giddings & Lewis Mch. Tool Co., Oakley, Cincinnati 9, Ohio.
Cross Co., P. O. Box 3835, Park Grove Postal Sta., Detroit 5, Mich.
Edlund Machinery Co., Cortland, N. Y.
Ettco Tool Co., Inc., 594 Johnson Ave., Brooklyn 37, N. Y.
Hamilton Tool Co., 834 S. 9th St., Hamilton, Ohio.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.
Kaufman Manufacturing Co., Manitowac, Wis.
Kingsbury Mch. Tool Corp., Keene, N. H.
Lamb, F. Joseph Co., 5663 E. Nine Mile Rd., Detroit 34, Mich.
Landis Mch. Co., Waynesboro, Pa.
Le Maire Machine Tool Co., 2657 S. Telegraph Rd., Dearborn, Mich.
Moline Tool Co., 102 20th St., Moline, Ill.
National Automatic Tool Co., Inc., S. 7th and N Sts., Richmond, Ind.
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 3, Ohio.
Zagar, Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio.

TAPS, Hand, Machine Screw, Pipe, etc.
DoAll Co., Des Plaines, Ill.
Greenfield Tap & Die Corp., Greenfield, Mass.
Jarvis Corp., Stack Ave., Middletown, Conn.
Sheffield Corp., Box 893, Dayton 1, Ohio.
Threadwell Tap & Die Co., Greenfield, Mass.
Winter Bros. Co, Rochester, Mich.

TAPS, Collapsing
Geometric-Horton Div., United Greenfield Corp., New Haven, Conn.
Greenfield Tap & Die Corp., Greenfield, Mass.
Landis Mch. Co., Waynesboro, Pa.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.
Sheffield Corp., Box 893, Dayton 1, Ohio.



We'll build the press for all your forging requirements . . .

Tell us your forging problems and give us your production specifications—we'll do the rest.

Erie Foundry, one of the first companies to automate forging, can provide specially designed *high volume* presses in capacities of 1000 to 8000 tons. Instead of the three machines and nine men formerly required, now you need only one Erie automated forging press and only one operator observer—to triple your present production rate! Trimming, too, can be accomplished in a single production cycle. With billet supply and finished part removal conveyorized, it is possible to achieve a production volume of, say, 1200 track-link forgings per hour.

Erie Foundry has a complete line of machines designed for high volume production of such parts as connecting rods, gear blanks, automotive and tractor valves, pinions, track links and wheel hubs.

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TESTING EQUIPMENT, Air, Oil & Water Pressure

Lamb, F. Joseph Co., 5663 E. Nine Mile Rd., Detroit 34, Mich.

THREAD CUTTING MACHINES

Davis & Thompson Co., 4460 W. 124th St., Milwaukee 10, Wis.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.
Landis Mch. Co., Waynesboro, Pa.
Sheffield Corp., Box 893, Dayton 1, Ohio.

THREAD CUTTING TOOLS

Armstrong Bros. Tool Co., 5213 W. Armstrong Ave., Chicago 46, Ill.
Geometric-Horton Div., United Greenfield Corp., New Haven, Conn.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.
Landis Mch. Co., Waynesboro, Pa.
Sheffield Corp., Box 893, Dayton 1, Ohio.

THREAD ROLLING DIES—See Dies, Thread Rolling

THREAD ROLLING EQUIPMENT

Landis Mch. Co., Waynesboro, Pa.
National Acme Co., 170 E. 131st St., Cleveland 3, Ohio.
National Machinery Co., Tiffin, Ohio.
Reed Rolled Thread Die Co., P. O. Box 350, Worcester 1, Mass.
Sheffield Corp., Box 893, Dayton 1, Ohio.
Waterbury Farrel Foundry & Mch. Co., Waterbury, Conn.

TOOL CONTROL BOARDS

Cross Co., P. O. Box 3835, Park Grove Postal Sta., Detroit 5, Mich.

TOOL HOLDERS

Armstrong Bros. Tool Co., 5213 W. Armstrong Ave., Chicago 46, Ill.
Bridgeport Mches, Inc., 500 Lindley St., Bridgeport 6, Conn.
Burgmaster Corp., 15001 S. Figueroa, Gardena, Calif.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland 14, Ohio.
Davis Boring Tool Div., Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
DeVlieg Microbore Div., 2720 W. Fourteen Mile Road, Royal Oak, Mich.
DoALL Co., Des Plaines, Ill.
Kennametal, Inc., Latrobe, Penna.
Metal Carbides Corp., 6001 Southern Blvd., Youngstown 12, Ohio.
Vascoloy-Ramet Corp., Waukegan, Ill.
Wesson Co., 1220 Woodward Heights Blvd., Detroit 20, Mich.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

TOOL MATERIAL, Cast Non-Ferrous Alloy

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Armstrong Bros. Tool Co., 5213 W. Armstrong Ave., Chicago 46, Ill.
Vascoloy-Ramet Corp., Waukegan, Ill.

TOOL MATERIAL, Cemented Carbide

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Armstrong Bros. Tool Co., 5213 W. Armstrong Ave., Chicago 46, Ill.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland 14, Ohio
DoALL Co., Des Plaines, Ill.
Kennametal, Inc., Latrobe, Penna.
Metal Carbides Corp., Youngstown 12, Ohio.
Vascoloy-Ramet Corp., Waukegan, Ill.
Wesson Co., 1220 Woodward Heights Blvd., Detroit 20, Mich.

TOOL MATERIAL, Ceramic

Metal Carbides Corp., Youngstown 12, Ohio.
Norton Co., 1 New Bond St., Worcester 6, Mass.
Vascoloy-Ramet Corp., Waukegan, Ill.

TOOL MATERIAL, High-Speed Steel

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Armstrong Bros. Tool Co., 5213 W. Armstrong Ave., Chicago 46, Ill.
Carpenter Steel Co., 105 W. Bern St., Reading, Penna.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland 14, Ohio.
du Mont Corp., Greenfield, Mass.
Jessop Steel Co., Washington, Penna.
Vanadium-Alloys Steel Co., Latrobe, Penna.

TRACING ATTACHMENTS

American Tool Works Co., Pearl & Eggleston Aves., Cincinnati 2, Ohio.
Gisholt Mch. Co., 1245 E. Washington Ave., Madison 10, Wis.
Gorton Mch. Co., 1321 Racine St., Racine, Wis.
Jones & Lamson Mch. Co., 512 Clinton St., Springfield, Vt.
Wales-Strippit, Inc., Akron, N. Y.
Warner & Swasey, 5701 Carnegie Ave., Cleveland 3, Ohio.

TRANSFER MACHINES

See Multiple-Station Machines

TRANSMISSION, Variable Speed

Barnes, John S. Corp., Rockford, Ill.
Boston Gear Wks., Quincy, Mass.
Denison Engineering, Div. American Brake Shoe Co., 1152 Dublin Rd., Columbus, Ohio.
Oilgear Co., 1569 W. Pierce St., Milwaukee, Wis.
Vickers, Inc., Detroit 32, Mich.

TRUCKS, Material Handling

Hamilton Tool Co., 834 So. 9th St., Hamilton, Ohio.

TUBE-FLANGING MACHINES

Niagara Mch. & Tool Wks., 637-697 Northland Ave., Buffalo 11, N. Y.

TUBE FORMING AND WELDING MACHINES

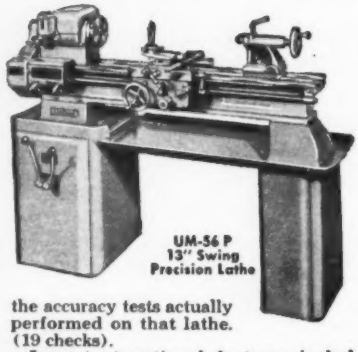
Yoder Co., 5504 Walworth Ave., Cleveland, Ohio.

TUBE MILLS

Yoder Co., 5504 Walworth Ave., Cleveland, Ohio.

SHELDON Precision LATHES

for the size Lathes You Need Most



UM-56 P
13" Swing
Precision Lathe

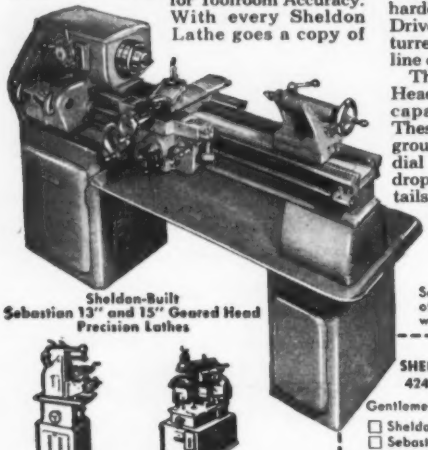
Sheldon lathes are built in the sizes you need most, for toolroom and production jobs. They are available with swings of 10", 11" and 13" . . . in varying bed lengths with 18" to 48" center distances . . . and . . . in your choice of pedestal, cabinet or bench mountings.

Powerful, all-V-belt, drive units—either the standard 8-speed (or 16-speed) E-drive; or the production favorite, a rapid, lever-shift U-drive. Where higher spindle speeds are desired, the standard E-drive can be built to provide speeds up to 2,000 r.p.m.

All Sheldon Lathes have handscraped, built-in precision. Each lathe is guaranteed to meet or surpass the American Standards for Toolroom Accuracy. With every Sheldon Lathe goes a copy of the accuracy tests actually performed on that lathe. (19 checks).

Important optional features include: hardened bed ways, L00 Long Taper Key Drive spindles, 4" D1 Camlock spindles, bed turrets, taper attachments and a complete line of toolroom and production accessories.

The new Sheldon-built Sebastian Geared Head Lathes have greatly increased work capacity and many advanced features. These include a wide, heavy, hardened and ground bed . . . easy shifting spindle speed dial . . . 60-pitch gear box . . . independent drop lever apron clutches . . . cam-action tailstock clamp . . . and, automatic lubrication in the headstock and apron with "1-shot" lubrication of carriage.



Sheldon-Built
Sebastian 13" and 15" Geared Head
Precision Lathes

Send in coupon or write for catalogs and names of nearest Sheldon and Sebastian Distributors where you can see these new lathes in operation.

SHELDON
Horizontal Milling Machine

SHELDON
12" Shaper

SHELDON MACHINE CO., Inc.

Builders of Sheldon Lathes, Milling Machines, Shapers and Sebastian Lathes.

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SHELDON MACHINE CO., INC.
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☐ Sheldon ☐ 10", ☐ 11" ☐ 13" Lathes
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☐ Horizontal Milling Machine ☐ Name of Local Dealer
☐ Sheldon 12" Shaper ☐ Have representative Call

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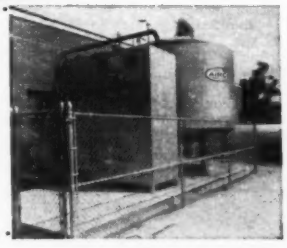
99.5% pure oxygen (O_2) ...by the ton or by the cylinder ... to a convenient location, inside or outside your plant ... for any process ... with absolute dependability

From more than 100 distribution and production points Airco today supplies American industry with oxygen and other high purity industrial gases. For the chemical industry ... missile fuel systems ... machine and manual cutting and welding ... steel making and processing ... flame hardening ... flame cleaning ... and for medical therapy and high altitude flight.

If you want to use oxygen for a new application or to improve the performance of current applications, Airco facilities are as near as your telephone.

Call in the Airco Engineering Service Representative. He is qualified to assist in planning a process with you from the very start. He is a long time expert in application techniques. He knows the rugged types of apparatus essential to oxygen processes. He knows in-plant distribution to consumption points. He knows how to make sure your supply will be ample at all times.

For O_2 ... Airco.



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TUBING, Non-ferrous
American Brass Co., 25 Broadway, New York, N. Y.
Metal Forming Corp., Elkhart, Ind.
Mueller Brass Co., Port Huron 34, Mich.
Revere Copper & Brass Inc., 230 Park Ave., New York, N. Y.
Ryerson, Jos. T., & Son, Inc., 16th & Rockwell Sts., Chicago 18, Ill.

TUBING, Steel
Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Carpenter Steel Co., 105 W. Bern St., Reading, Penna.
Metal Forming Corp., Elkhart, Ind.
National Tube Div., U. S. Steel Corp., 525 Wm. Penn Place, Pittsburgh, Pa.
Revere Copper & Brass Inc., 230 Park Ave., New York 17, N. Y.
Ryerson, Jos. T., & Son, Inc., 16th & Rockwell Sts., Chicago 18, Ill.
Timken Roller Bearing Co., Canton, Ohio.

TUBE & PIPE CUTTING-OFF MACHINES
Grieder Industries, Inc., Bowling Green, Ohio.
Sheffield Corp., Box 893, Dayton 1, Ohio.

ULTRASONIC MCH. TOOLS
Sheffield Corp., Box 893, Dayton 1, Ohio.

VALVE CONTROLS
Barnes, John S. Corp., Rockford, Ill.
Logansport Mch. Co., Inc., Logansport, Ind.
Vickers, Inc., Detroit 32, Mich.

VALVES, Air
Hydraulic Press Mfg. Div., Mt. Gilead, Ohio.
Logansport Mch. Co., Inc., Logansport, Ind
Mechanical Air Controls, Inc, Oak Park, Mich.
Ross Operating Valve Co., 110 E. Golden Gate Ave., Detroit 3, Mich.
Schrader's Son, A., 470 Vanderbilt Ave., Brooklyn 38, N. Y.
Skinner Electric Valve Div., New Britain, Conn.
Tomkins-Johnson Co., 617 N. Mechanic St., Jackson, Mich.

VALVES, Hydraulic
Barnes, John S. Corp., Rockford, Ill.
Denison Engineering Div. American Brake Shoe Co., 1152 Dublin Rd., Columbus 16, Ohio.
Elmes Eng. Div., American Steel Foundries, 1150 Tennesee Ave., Cincinnati 29, Ohio
Hydraulic Press Mfg. Div., Mount Gilead, Ohio.
Logansport Machine, Inc., 810 Center Ave., Logansport, Ind.
Oilgear Co., 1569 W. Pierce St., Milwaukee, Wis.
Vickers Incorporated, Division of Sperry Rand Corp., 1402 Oakman Blvd., Detroit, Mich.

VERNIERS—See Calipers, Vernier; Gages, Vernier

VISES, Machine
Bridgeport Mches, Inc., 500 Lindley St., Bridgeport 6, Conn.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling & Grinding Mches., Inc., 4701 Marburg Ave., Cincinnati 9, Ohio.
Cincinnati Milling Mch. Co., Oakley, Cincinnati 9, Ohio.
L-W Chuck Co., Toledo 4, Ohio
Logansport Machine Co., Inc., 810 Center Ave., Logansport, Ind.
Modern Mch. Tool Co., 2005 Losey Ave., Jackson, Mich.
Universal Engineering Co., Frankenmuth 2, Mich.
Wesson Co., 1220 Woodward Heights Blvd., Detroit 20, Mich.

WELDING EQUIPMENT, Arc
Air Reduction Sales Co., 150 E. 42nd St., New York 17, N. Y.
Lincoln Electric Co., 22801 St. Clair Ave., Cleveland, Ohio.
Linde Co., 30 E. 42nd St., New York 17, N. Y.

WELDING EQUIPMENT, Gas
Air Reduction Sales Co., 150 E. 42nd St., New York 17, N. Y.
Linde Co., 30 E. 42nd St., New York 17, N. Y.

WELDING EQUIPMENT, Resistance
Eisler Engrg. Co. Inc., 750 South 13th St., Newark, N. J.

WELDING POSITIONERS
Eisler Engrg. Co., Inc., 750 South 13th St., Newark, N. J.

WELDMENTS
Bliss, E. W. Co, Canton, Ohio.
Verson Allsteel Press Co., 93rd St. & S. Kenwood Ave., Chicago, Ill.

WIRE
Allegheny Ludlum Steel Corp., Pittsburgh, Pa. (Stainless)
Bethlehem Steel Co., Bethlehem, Pa.
Carpenter Steel Co., 105 W. Bern St., Reading, Penna.
U. S. Steel Corp., 525 Wm. Penn Pl., Pittsburgh 30, Penna.
Vanadium-Alloys Steel Co., Latrobe, Penna.

WIRE FORMING MACHINES
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Eisler Engrg. Co., Inc., 750 South 13th St., Newark, N. J.
U. S. Tool Co., Inc., 255 North 18th St., Ampere, E. Orange, N. J

WOODWORKING MACHINES
Greaves Mch. Tool Div., 2011 Eastern Ave., Cincinnati 2, Ohio.
Greenlee Bros. & Co., 2136—12th St., Rockford, Ill.

WRENCHES, Allen, End, Socket, Adjustable, etc.
Allen Mfg. Co., Bloomfield, Conn.
Armstrong Bros. Tool Co., 5213 W. Armstrong Ave., Chicago 46, Ill.
Chicago Pneumatic Tool Co., 6 E. 44th St., New York 17, N. Y.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

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Box Cams

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Get the benefits . . . of experience, service and economy . . . by coming to Rowbottom for any and all types of cams, cam millers, cam grinders and rotary profilers. We can produce cams for you or can furnish the machines for producing them.

If you need box, barrel, face or side cams . . . if you need cams heat treated to your specifications with bore and cam shapes ground to your exacting requirements . . . take advantage of Rowbottom's many years of pioneering and specialization in cam development exclusively . . . a complete service which meets all demands for precision and speed. *Remember:* all types in any quantity, promptly to your specifications.

Send us your specifications

The ROWBOTTOM MACHINE CO.
WATERBURY, CONN.

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SPURS TO 72" PD. 1 DP
BEVELS TO 54" PD. 1 DP
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GEAR & MACHINE COMPANY
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CLEVELAND 14. OHIO

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The things that make life worth living are more convenient in CIPStowns . . . fishing, golf and other outdoor sports . . . social and cultural activities . . . good schools, friendly neighborhoods. And, they're all just minutes away from your desk.

Progressive folks in the more than 500 small and medium-sized communities served by Central Illinois Public Service Company invite you to locate your new plant here in the center of the nation's population. You'll be close enough to resources and markets . . . far enough from congested metropolitan areas.

For information on available plant sites, write, wire or call our Industrial Manager. He'll serve as your confidential assistant.

CIPS **CENTRAL ILLINOIS PUBLIC SERVICE COMPANY**
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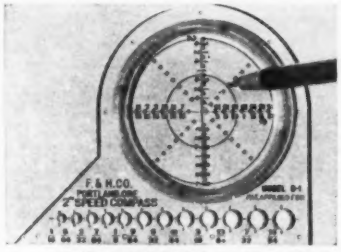

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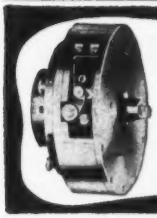

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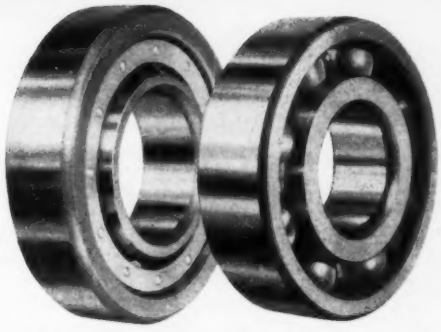

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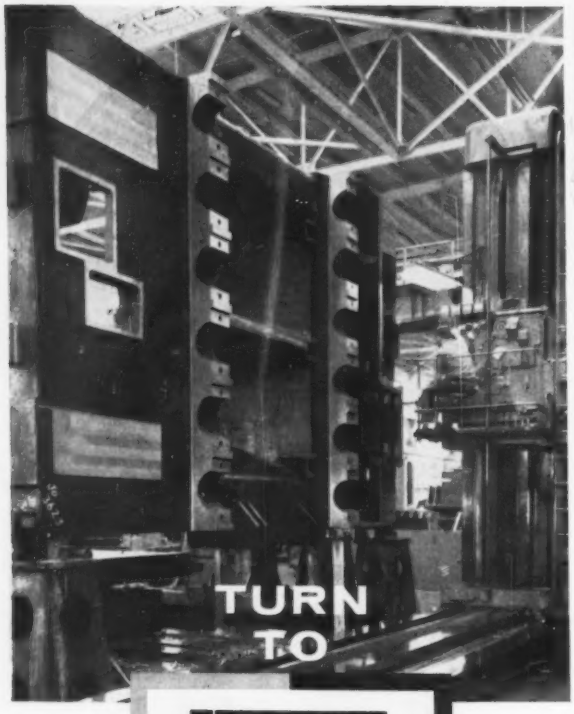

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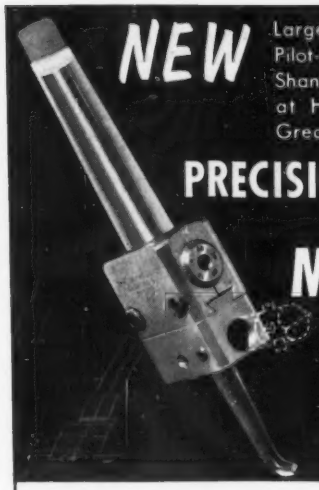

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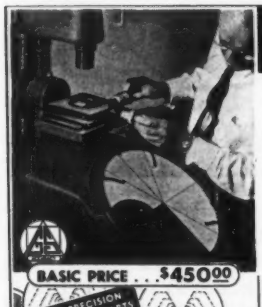
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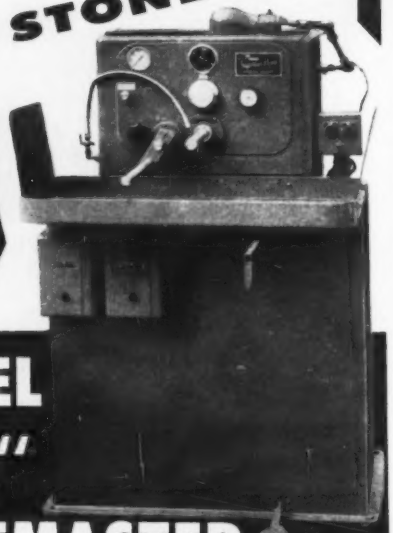

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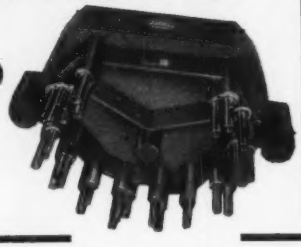

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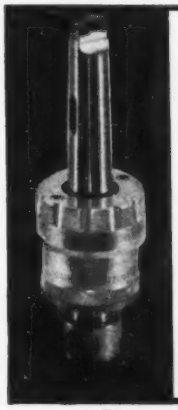

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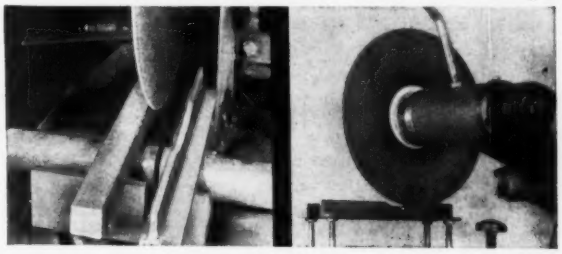

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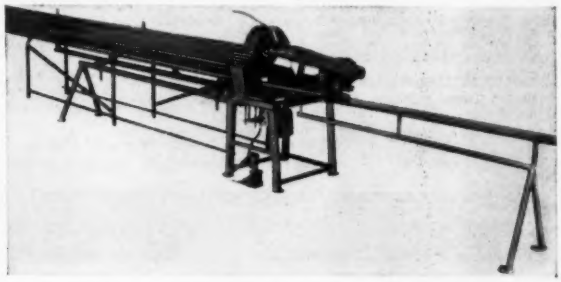

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36"x36"x12' Betts, m.d., 3 heads
36"x36"x12' G. A. Gray, 2 heads
36"x36"x18' table Cincinnati Double Housing m.d.
36"x36"x20' table Cincinnati H.P. Double Housing, m.d. belted
48"x48"x18' Niles-Bement-Pond, 2 heads, belt
48"x48"x28' Cincinnati, reversing m.d. 4 heads
56"x42"x14' Cincinnati, belt drive, 2 heads

HAND MILLERS

No. 1M Kent-Owens, m.d., late

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No. 00 Sundstrand Rigidmill, m.d.
No. 000 Brown & Sharpe Plain Production, m.d.
No. 08 Cincinnati, rise and fall, 1944
M80 Taylor & Fenn Duplex, spline, m.d.
No. MM-1-6 U.S. Multi-Miller, m.d.
No. 33H Sundstrand Trimplex Rigidmill, m.d.
No. 3A Sundstrand Plain Automatic Rigidmill, m.d.
24" Cincinnati Duplex Automatic, m.d.
54"x30"x16' Ingersoll Slab Miller, m.d.
Model 1402 Kearney & Trecker Simplex, m.d., production
Model 1404 Kearney & Trecker Simplex, m.d., production
No. 12 Brown & Sharpe Plain Horizontal, m.d.
No. 2-24 Cincinnati Plain Automatic, rise and fall, m.d.
3-24" Cincinnati Plain Hydromatic, m.d. in base
3-36" Cincinnati Duplex Hydromatic, m.d. in base
No. 4-36 Cincinnati Plain Hydromatic, m.d.
Model 33-1536 Sundstrand Simplex Fluid Screw Type Rigidmill, m.d.
No. 34-36 Cincinnati Semi-Special Plain Hydromatic, tracer control
28"x144" Cincinnati Plain Hydromatic, m.d., late
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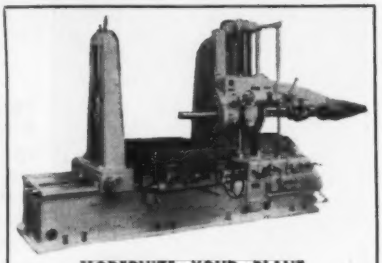

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TANGENT BENDER, double wing cabinet type, 1949
DYNAMIC TINIUS OLSEN BALANCER, 16" x 36", 1948
47A HEALD BOREMATIC, single end, 1944, 3 heads
2U SIMPLEX DOUBLE END BORER, 2 heads, 1942
DB1212 EXCELLO DOUBLE END BORER, late
BROACH, American, pull type, 18 ton 42" Str.
BROACH, type XD-20-66 Oilgear, twin surface, late
1¼" CUTOFF, 4 spindle Conomatic
650 CFM SULLIVAN COMPRESSOR, angle compound, 125 HP
DEEP HOLE DRILL, Model 420 Barnes, 3" dia. x 96" ctr.
4' x 11" CARLTON RADIAL, late
221½ BARNES UPRIGHT DRILL, all geared, late
TYPE A GEAR HOBBER, Barber Colman, 1944
NO. 2 CINCINNATI CENTERLESS, Filmatic, late
10" x 36" NORTON CYLINDRICAL GRINDER, type C, plunge, late
20" x 72" type D LANDIS CYLINDRICAL GRINDER, late
72A3 HEALD INTERNAL, Gagematic and Sizematic, several
12" x 48" THOMPSON SURFACE GRINDER, Horiz. spil., late
No. 2 CINCINNATI T & C grinder, 1944
224-B BARNES VERTICAL HONE, hydraulic, 1946
58" x 16' cc LODGE & SHIPLEY LATHE, patent head, open geared
25" x 72" AXELSON LATHE, heavy duty, 1944
30" x 96" cc AMERICAN LATHE, geared head, rebuilt
No. 12 GISHOLT AUTOMATIC LATHE, hydraulic, 1945
16" x 33" cc FAY AUTOMATIC LATHE, F & R slides
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No. 4 J & L TURRET LATHE, universal ram type, late
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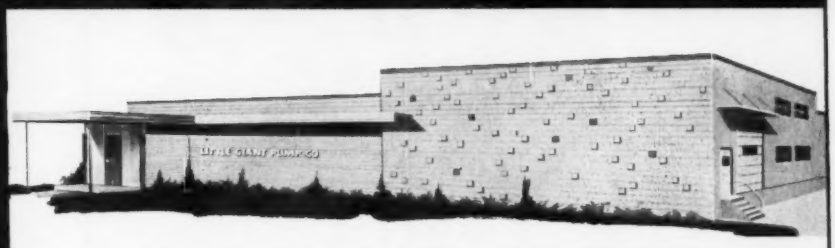

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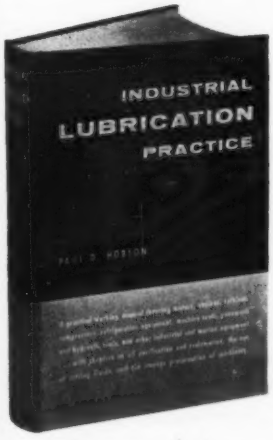

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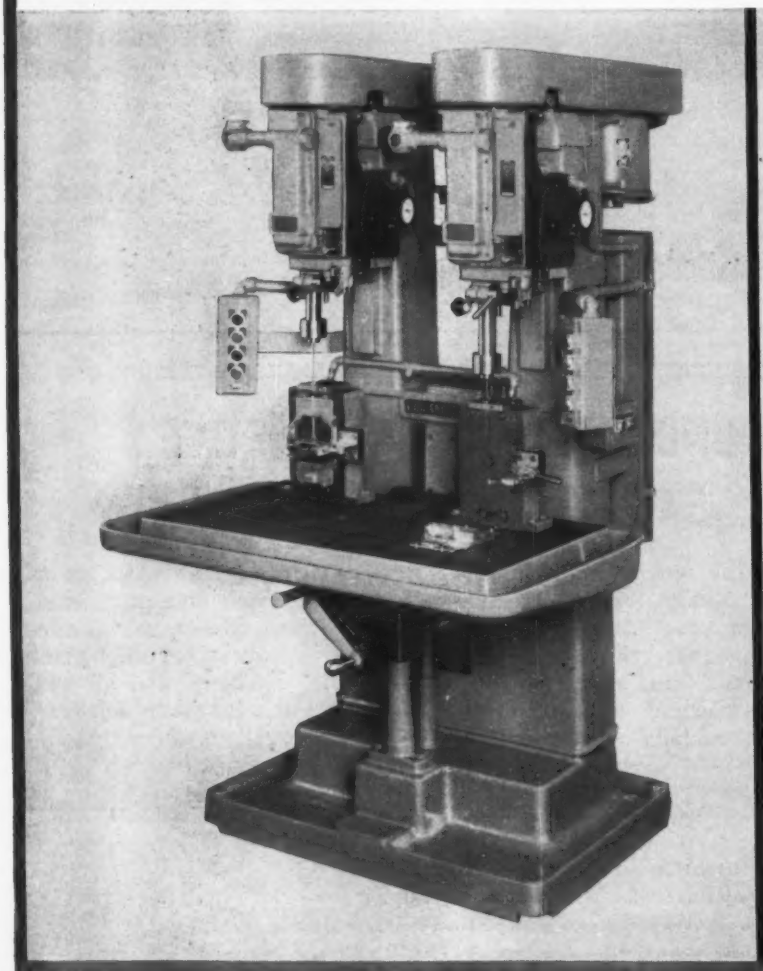

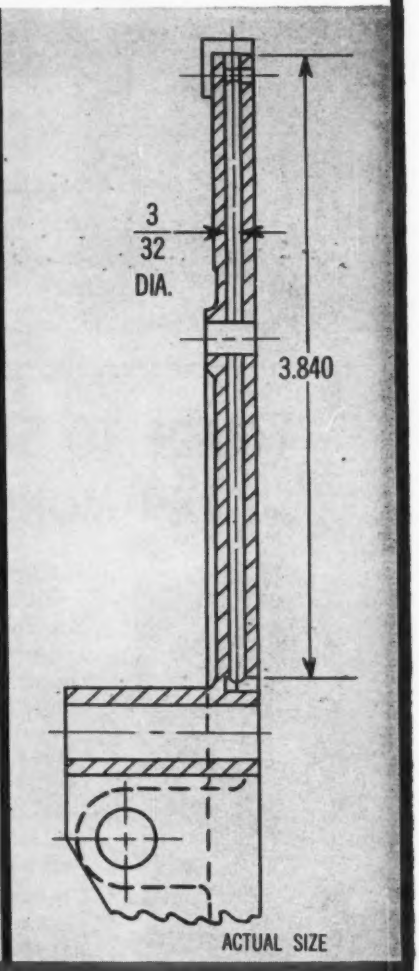

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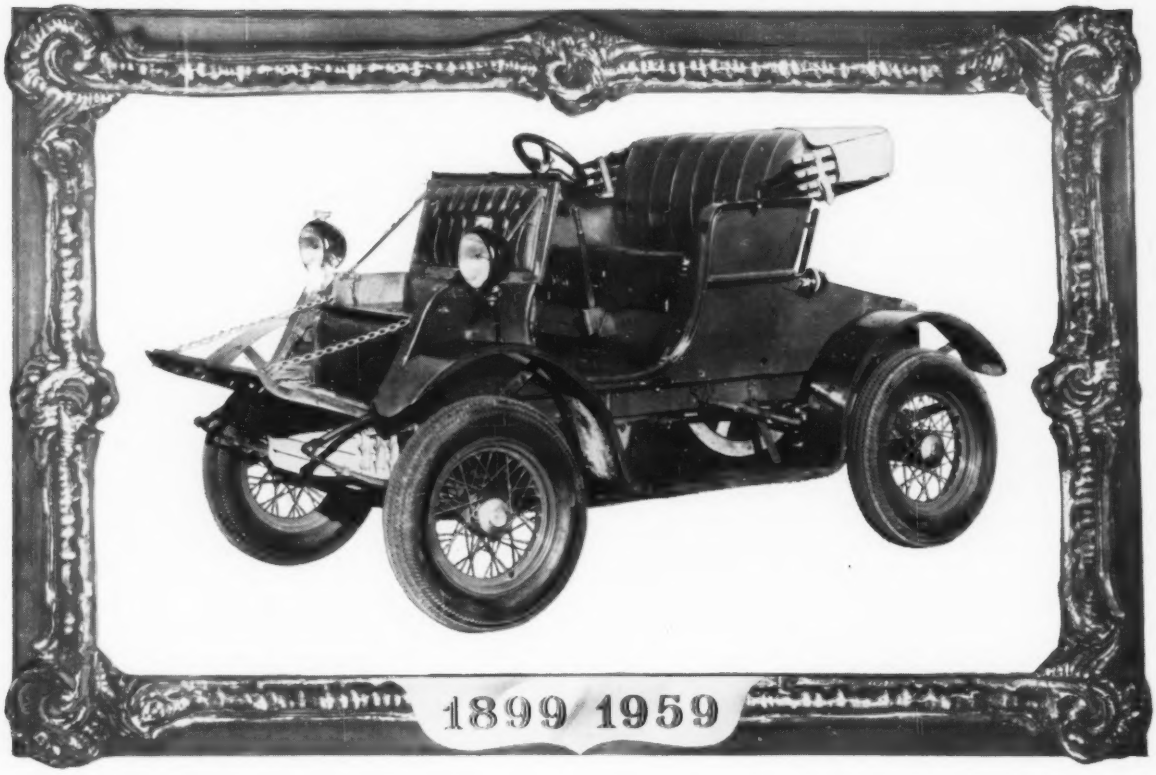

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